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PC MAGAZINE

First Looks: The First 66-MHz Systems Race Through Our Tests

Essential Tools: Our Editors Pick Their Favorite Utilities

DOS Lives! Why It Keeps Hanging Around

PC LABS REVIEWS

58 486SX/25s

The New Low-Cost PC Standard Offers 486 Performance, a 200MB Hard Disk, and An SVGA Monitor for as Little as $1,500

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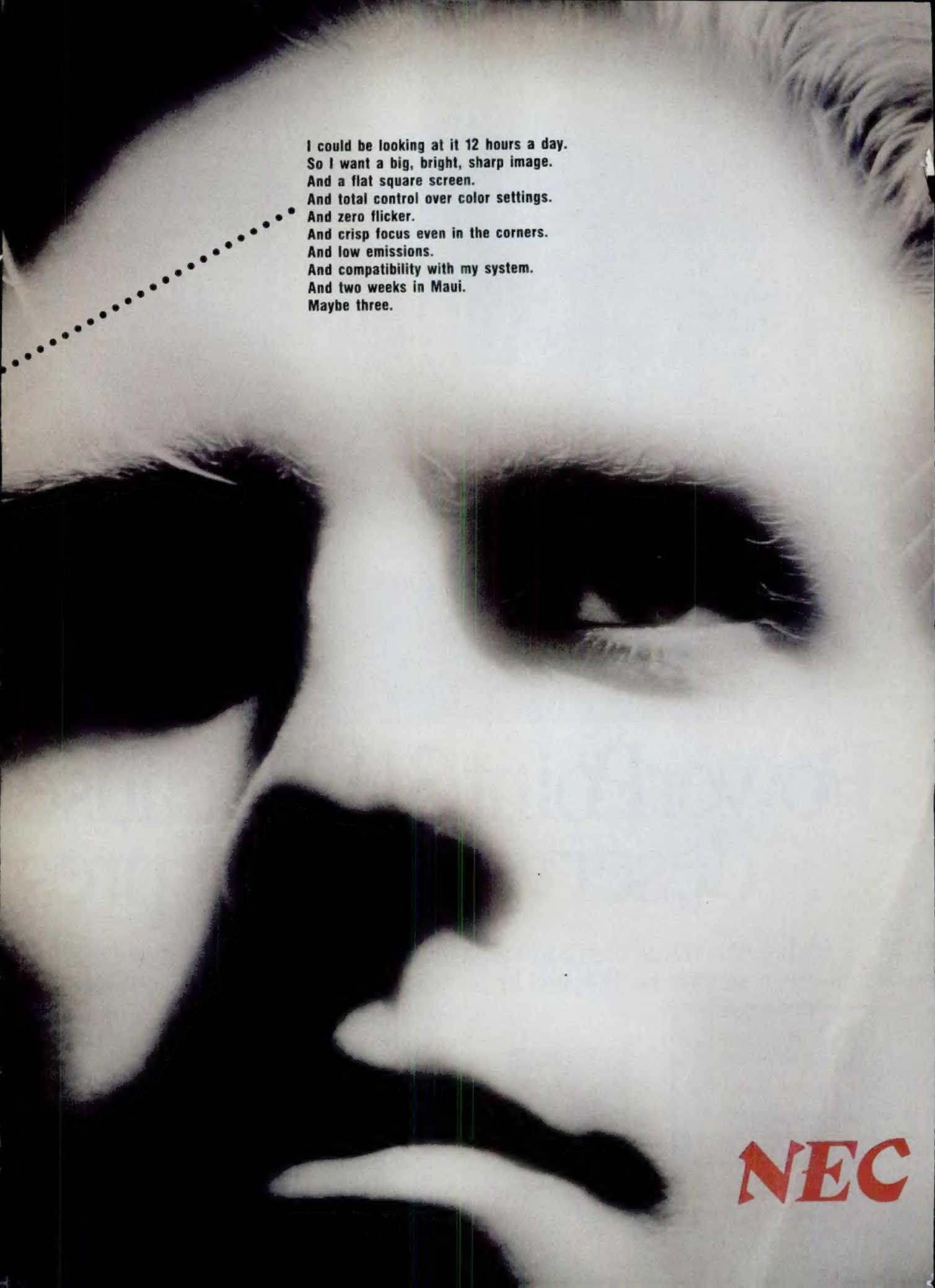
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So I want a big, bright, sharp image.
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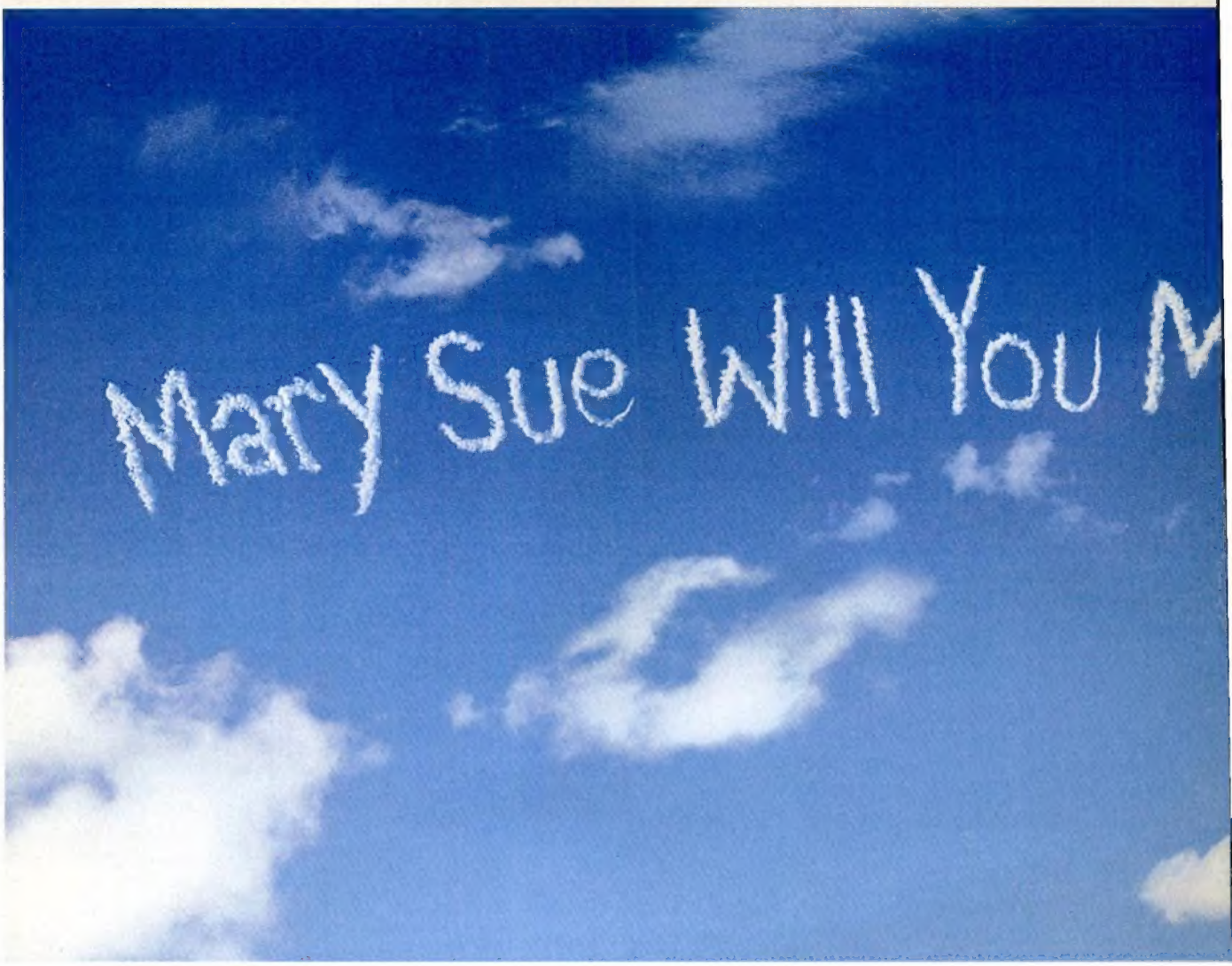
And total control over color settings.
And zero flicker.
And crisp focus even in the corners.
And low emissions.
And compatibility with my system.
And two weeks in Maui.
Maybe three.
NEC



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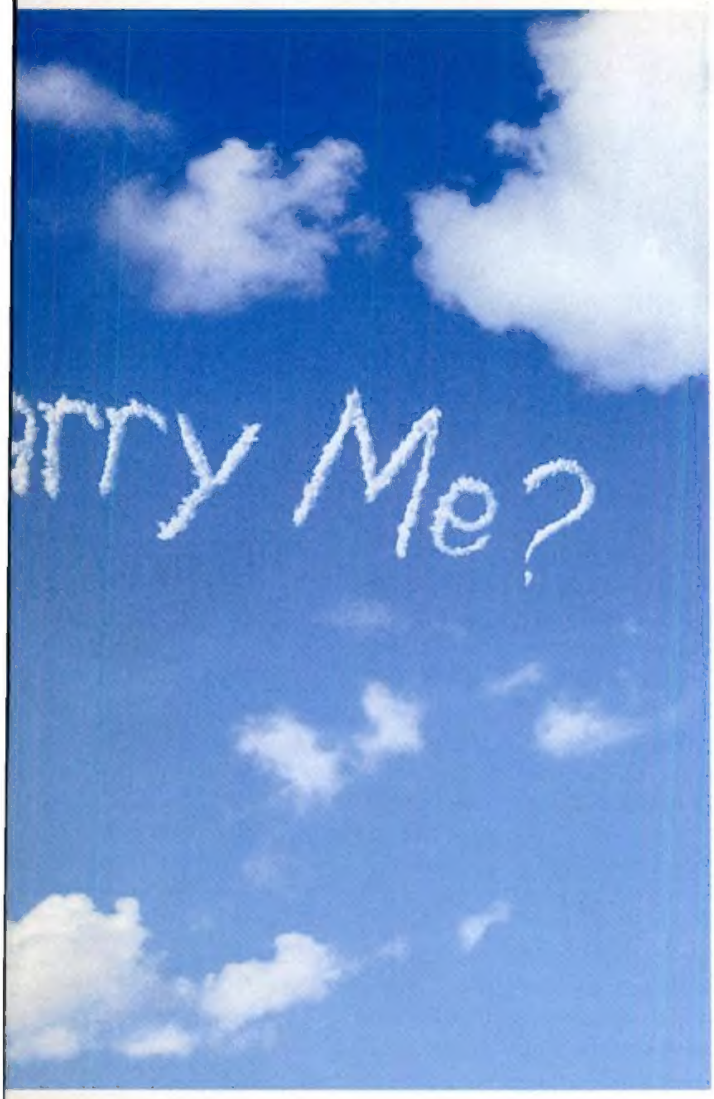

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Inside

There is a vocal segment of our audience that would not hesitate to tell us it was about time we lauded their beloved DOS and text-based programs. It *has* been the year of the graphical user interface. Both Windows and OS/2 have dominated the industry dialog as they jockeyed for hearts, minds, and CPUs to run on. Following the laws of momentum, software vendors have been feverishly shipping products for Windows—and to a far lesser extent, OS/2. DOS fanatics have felt neglected, and not without reason.

However, economic reality is now setting in. Windows may be sexy, but DOS is where most of the work gets done. Microsoft claims that 10 million copies of Windows are now in circulation, and IBM says 1 million copies of OS/2 have been shipped. Assume that 75 percent of these are in use most of the time and you get 8.25 million computer users who favor a graphical user interface. With an estimated 100 million PCs in use worldwide, some 92 million users are absolutely, positively non-GUI.

Petzold

The software community has finally realized the potential of that mature marketplace. Windows may be the fastest-growing software market, but DOS is still the biggest. "DOS Lives!," our feature on the state of DOS, reports that a number of new text-based versions of old reliables such as Lotus 1-2-3, Microsoft Word, and WordPerfect are on the way, along with completely new ones like DosFax PRO and The Norton Desktop For DOS, which borrow liberally from the GUI concept without sacrificing the speed that endears text-based programs to many of us. Two of our contributing editors take different stands on the future of DOS. Jeff Prosise paints an optimistic view of its future in his introduction to our main story, while Charles Petzold, an advocate of graphical environments, explains why he thinks "DOS must die."

Prosise

The point of all this contention, of course, is that we are in a long, slow transition to a world of multiple environments. Until the end of the century, at least, no single operating system—no single computing style—is likely to dominate. Our feature on the best utilities for DOS, Windows, and OS/2 reflects PC users' desire to work their own way. New technologies and new ways of relating (like networks and workgroups) come and go, but the "personal" in PC remains an important ideal.—*Joel Dreyfuss*

PC Magazine: The Independent Guide to Personal Computing, ISSN #0888-8507 is published biweekly except in July and August for $44.97 for one year. Ziff-Davis Publishing Co., a division of Ziff Communications Co., One Park Ave., New York, NY 10016. Second class postage paid at New York, NY 10016 and at additional mailing offices. POSTMASTER: Address changes to *PC Magazine,* P.O. Box 54093, Boulder, CO. 80321-4093.

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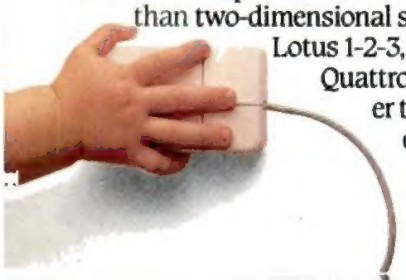

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COVER PHOTOGRAPH BY ENRIQUE CUBILLO

COVER STORY

25-MHz 486SXs

486SX: The New Entry-Level PC

BY MATTHEW J. ROSS PCs based on Intel's 25-MHz 486SX CPU represent an affordable entry level for serious business-oriented PC users who don't need a math coprocessor. And if 25 MHz is not fast enough, most systems allow easy upgrades to 50-MHz 486 DX2 CPUs through OverDrive or ZIF sockets. PC Labs reviews 58 systems built around the 486SX/25 .....**114**

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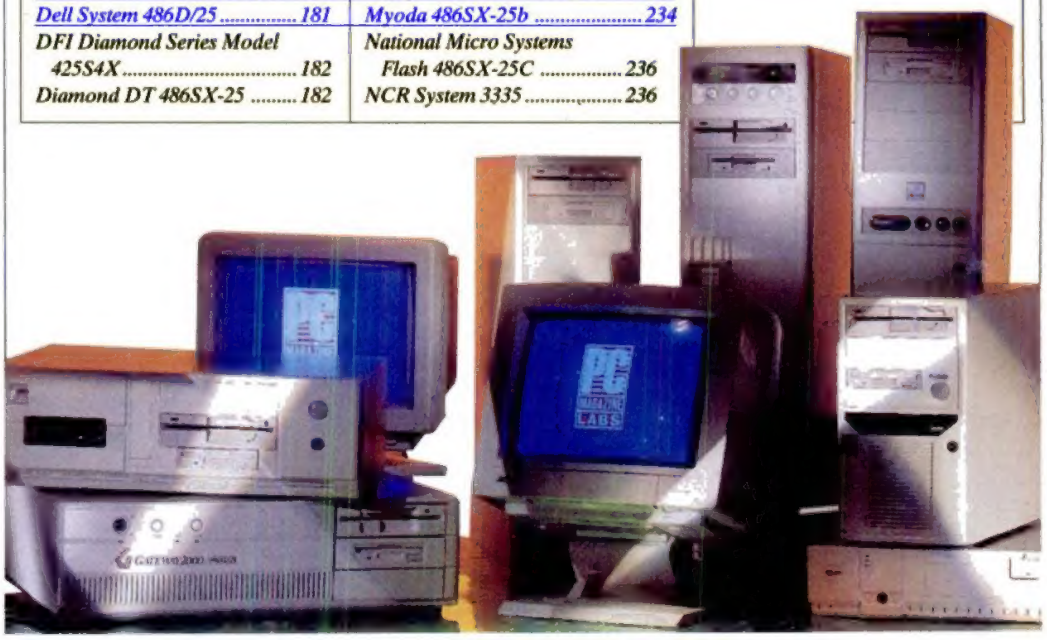

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FEATURES

Operating Systems

DOS Lives!

BY JEFF PROSISE From the press that Windows and OS/2 have been getting, it might appear that DOS is dead—a thing of the past. But 90 percent of PC users continue to use DOS as their primary operating environment. Its modest hardware requirements and low overhead give DOS some undeniable advantages over other systems. We'll take a look at new DOS products in seven different categories and describe how they exploit these advantages 259

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PC MAGNET—Available on PC MagNet.

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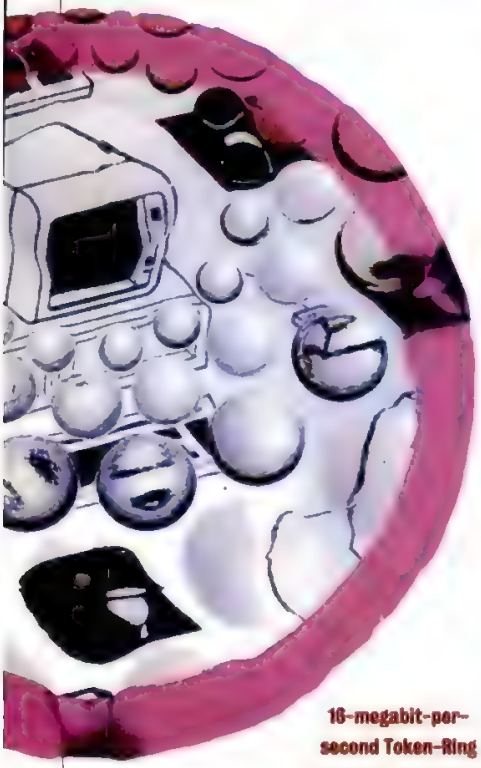

16-megabit-per-second Token-Ring adapters give your PC access to a fast moving ring of network traffic (page 333).

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Tiny keys and a washed-out display are one thing, but, oh, the software. Abort, Retry, Fail? (page 526).

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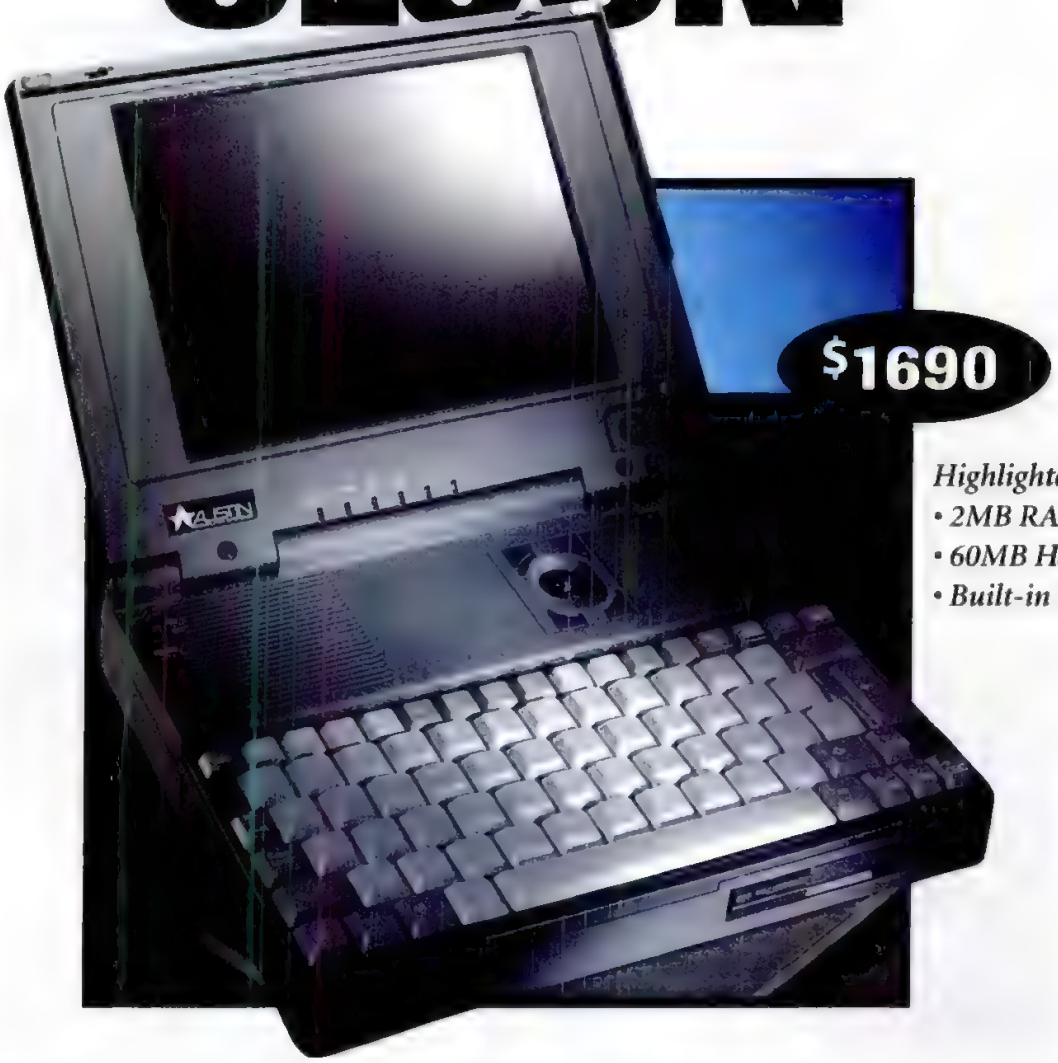

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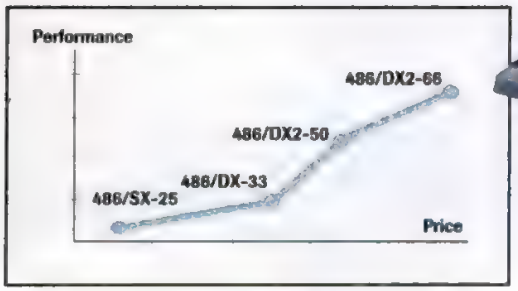

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PC Magazine Contributing Editor Winn L. Rosch

A U S

PC-AB-2

486/SLC-25 WinStation	386/33 WinStation	486/DLC-33 WinStation	486/33 WinStation	486/DX2-50 WinStation
Cyrix 486SLC, running at 25MHz	Intel i386, 33MHz w/64K Cache (to128K/256K)	Cyrix 486DLC, 33MHz w/64K Cache (128K/256K)	Intel i486, 33MHz w/64K Cache (to 256K)	Intel i486DX2, 50MHz w/64K Cache (to 256K
2MB RAM (to 32MB)	4MB RAM (to 32MB	4MB RAM (to 32MB)	4MB RAM (to 32MB)	4MB RAM (to 32MB
40MB Hard Drive	80MB Hard Drive	120MB Hard Drive	210MB Hard Drive	210MB Hard Drive
14" VGA 640x480 Color Monitor w/256K Video RAM	14" VGA 640x480 Color Monitor w/256K Video RAM	14" VGA 640x480 Color Monitor w/256K Video RAM	14" VGA 1024x768 Non Interlaced Color Monitor w/Windows Accelerator	14" VGA 1024x768 Non Interlaced Color Monitor w/Windows Accelerator
1.44MB & 1.2MB Floppy Drives	1.44MB & 1.2MB Floppy Drives	1.44MB & 1.2MB Floppy Drives	1.44MB & 1.2MB Floppy Drives	1.44MB & 1.2MB Floppy Drives
101-Key Keyboard	101-Key Keyboard	101-Key Keyboard	101-Key Keyboard	101-Key Keyboard
DOS 5.0/Windows 3.1/ Mouse	DOS 5.0/Windows 3.1. Mouse	DOS 5.0/Windows 3.1 Mouse	DOS 5.0/Windows 3.1 Mouse	DOS 5.0/Windows 3.1 Mouse
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486/50 WinStation	486/DX2-66 WinStation	486/DX2-50 EISA WinStation	486/DX2-50 EISA WinTower	386/SX25 Notebook
Intel i486 running at 50MHz w/64K Cache (to 256K)	Intel i486DX2 running at 66MHz w/128K Cache (to 256K)	Intel i486DX2 running at 50MHz w/128K Cache (to 256K)	Intel i486DX2 running at 50MHz w/128K Cache (to 256k	386SX running at 25MHz 4MB RAM (to 8MB)
4MB RAM (to 32MB)	4MB RAM (to 32MB)	8MB RAM (to 32MB)	8MB RAM (to 32MB)	60MB Hard Drive
210MB Hard Drive	210MB Hard Drive	210MB Hard Drive	330MB HD, EISA/SCSI Cont.	9.4" VGA LCD Display, 640x480 w/ 32 gray scale
14" VGA 1024x768 Non-Interlaced Color Monitor w/Windows Accelerator	14" VGA 1024x768 Non-Interlaced Color Monitor w/Windows Accelerator	14" VGA 1024x768 Non-Interlaced Color Monitor w/Windows Accelerator	14" VGA 1024x768 Non Interlaced Color Monitor w/Windows Accelerator	1.44MB Floppy Drive Send Receive Fax Modem
1.44MB & 1.2MB Floppy Drives	1.44MB & 1.2MB Floppy Drives	1.44MB & 1.2MB Floppy Drives	1.44MB & 1.2MB Floppy Drives	Built In Track Ball 79-Key Keyboard
101-Key Keyboard	101-Key Keyboard	101-Key Keyboard	101-Key Keyboard	DOS 5.0, Windows 3.1,
DOS 5.0/Windows 3.1/ Mouse	DOS 5.0/Windows 3.1/ Mouse	DOS 5.0/Windows 3.1/ Mouse	DOS 5.0/Windows 3.1 Mouse	PFS Window Works, and Contact Manager
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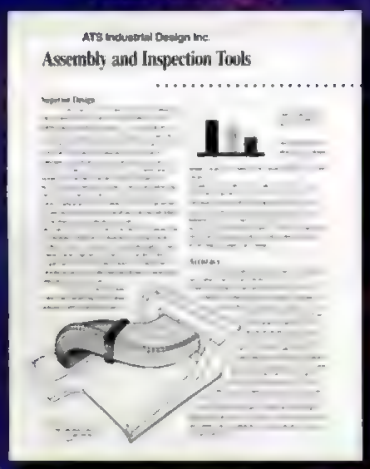

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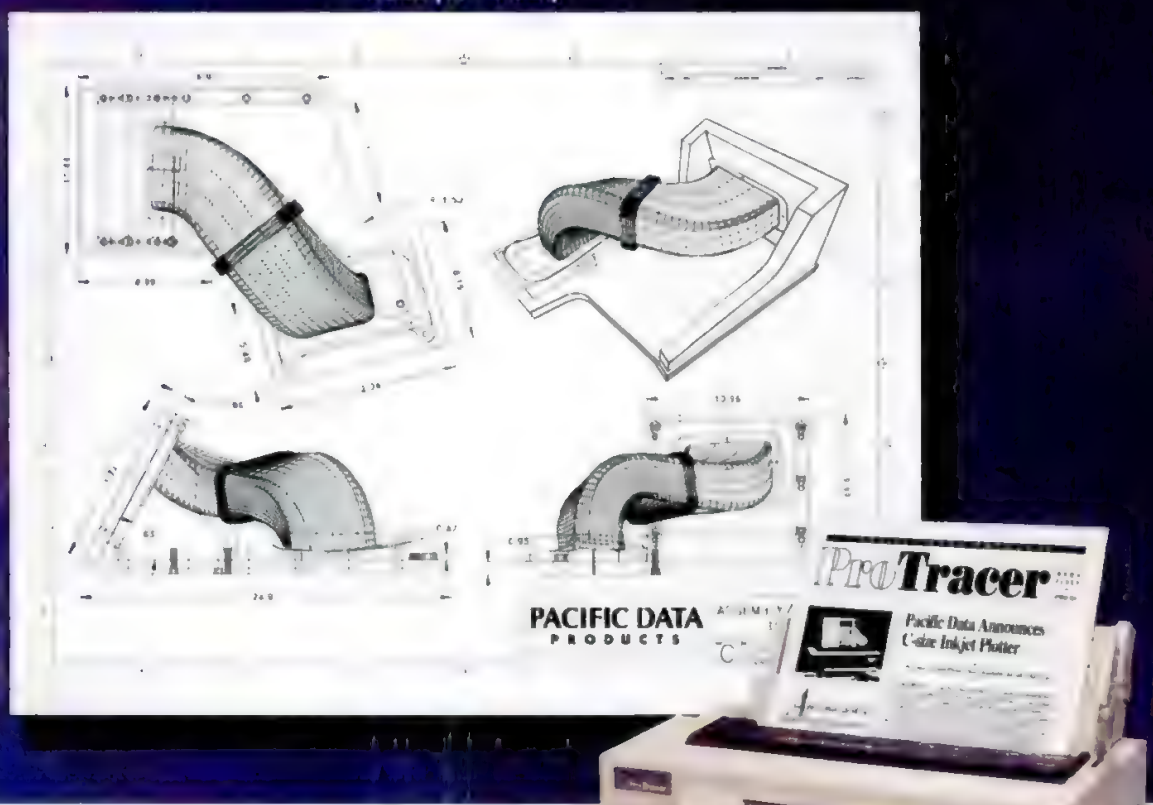

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Letters

A CHIP BY ANY OTHER NAME

I can understand Bill Machrone's concern about the industry calling the Cyrix chip a 486, and I'll let others question the technical validity of some of his statements in his column "Honest Abe and the 486" (August 1992).

What I can't let go unchallenged is Machrone's characterization of these chips as suitable for "bottom-of-the-line direct-market machines." This simply isn't true.

Cyrix has skillfully exploited a price/performance niche that other chip manufacturers have not, allowing PC makers to develop a new class of reliable, high-performance products that appeal to value-conscious buyers who happen to be very discriminating.

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Bill H. Hayden
Chairman and CEO
CompuAdd Computer Corp.
Austin, Texas

Bill Machrone's "Honest Abe and the 486" editorial in the August issue of *PC Magazine* was riddled with factual errors and misleading statements. Cyrix respects Machrone's right to his opinion that *x*86 microprocessors should be named according to their bus interfaces, but the company does not respect Machrone's lack of veracity.

Cyrix named the Cx486SLC (TM) and Cx486DLX (TM) CPUs based on the 486SX instruction-set compatibility and 486-class CPU performance. This decision is consistent with computer industry practice over the past 30 years.

We strongly disagree with Machrone's opinion and strongly object to his utter disregard for factual accuracy and disparagement of Cyrix and its customers. Furthermore, the use of Abe Lincoln's image of integrity to endorse a slanted opinion is offensive.

Honest Abe and the 486

What makes a 486 processor a real 486? Opinions run strong

Jim Chapman
VP Marketing
Cyrix Corp.
Richardson, Texas

• 1. The Cyrix chip fully supports the 386 and 486 instruction sets. Like the Intel 486, The Cyrix Cx486SLC executes common integer instructions in one clock cycle. The Intel 386 line commonly performed such instructions in two cycles.

2. Bill Machrone's references to external-memory communication rate differences were perhaps not as clear as they could have been. Both the 286 and 386 chips were designed to access memory in two clock cycles. Intel's 486 processor also accesses memory in two clock cycles, but it has a burst-mode interface, allowing back-to-back memory reads in fewer clock cycles. Cyrix's Cx486SLC does not have a burst mode, but Cyrix says this has only a minor effect on performance.

3. The Cyrix chip does have an on-board integer multiplier, which speeds up multiplication-intensive software, such as certain graphics operations on nonaccelerated video systems. Cyrix lacks a floating-point math coprocessor chip to complement the Cx486SLC.

4. The timing signals on the Cx486SLC and the 386SX chip are the same. According to Cyrix, its chip functions correctly in 386SX motherboards, although original equipment manufacturers must make some changes to get the performance improvements.

Bill Machrone stands by his main point: Because the Cyrix Cx486SLC has only a 16-bit data path and a 1K internal cache, compared with the 32-bit data path and 8K internal cache of the Intel 486SX, the 486 name may be misleading to some end users.

Machrone did say that "people who by machines based on it will get snappy performance at a reasonable price." He adds that more leading vendors are incorporating the Cyrix Cx486SLC in their systems.—Ed.

A CHANGE OF HEART

I read John C. Dvorak's love letter to OS/2 2.0, "My Wife Thinks I'm Nuts" (August 1992). Since his previous columns don't exactly read like IBM marketing fluff, I found myself scratching my head to recall the reviews I was sure I had read indicating that OS/2 was a mess.

Windows is a kludge for the lazy and technically inept. I wanted a real working 32-bit operating system and thought OS/2 was the answer, but my experience and that of others tells me "it ain't so." Is Dvorak talking about the same OS/2 I'm talking about?

Dennis R. Norwood
San Francisco, California

I got a lump in my throat when John C. Dvorak said that after his first computer choked on OS/2 and died, he just went out and replaced it with an even bigger one. Excuse me, pal, but most people don't have an open expense account that allows us to trash computers at will and then memo the boss for another one. Come down to earth, Mr. Dvorak. With that 459MB supercollider you call a computer, I would like to know what software wouldn't run great. "The right hardware" nuts; you're packing an arsenal.

Jeff R. Gibbons
Westlake Village, California

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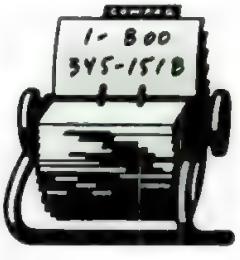

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CIRCLE 203 ON READER SERVICE CARD

LETTERS

I must disagree with John C. Dvorak's rave review of OS/2 2.0. While I found it exceptionally easy to install, I did encounter unrecoverable crashes when using my applications.

Also, the manuals are a nightmare. It is very hard to find anything. I eventually returned the program because from my point of view it just was not easy enough to use.

Dom Mazzoccoli
Newington, Connecticut

I agree with John C. Dvorak 100 percent about the fanatics and whiners. I also agree that OS/2 is the way to go.

By the way, both Windows and OS/2 include mini-applications, which can be nice. What I would really like is for them to include a spell-checker so you don't end up with a dozen spell-checkers from a dozen different applications.

Howard Brazee
Lakewood, Colorado

NIX HIX KIX

John C. Dvorak's description of a Portland suburb as "the hick town of Troutdale, Oregon" shows his big-city, big-market bias (Inside Track, August 1992).

While it's true that Troutdale has many working farms, this community virtue is fast disappearing. I haven't followed any slow-moving combines down the road in years, nor have I noticed any local residents scraping manure from their Gucci slip-ons.

Alan Stone
Portland, Oregon

DIRTY SECRET OF WINDOWS SECRETS

Michael J. Miller explains how to play video game–like stunts with Windows 3.1, Word for Windows 2.0, and Ami Pro 2.0 to get developer names and pictures on the screen ("The Secrets Behind Windows," August 1992).

Now, would someone please tell us how much disk space this junk takes, how much memory the support code occupies, and best of all, how to get rid of it all.

Mike Firth
Dallas, Texas

A SHEEP IN WOLF'S CLOTHING?

PC Magazine is doing its readers a disservice by indicating that Cyrix's modified 386 processor is a 486. Nowhere in the article comparing the PC Brand 486/SLC Notebook with the Twinhead Slimnote 486DX/33 (First Looks, August 1992) do the authors mention that the 486/SLC is nothing but advertising hype.

Steve Polowichak
Johns Island, South Carolina

BY THE WAY...DO YOU HAVE ANY (COPY) PROTECTION?

Bill Machrone proudly recounts *PC Magazine*'s decision to deny Editors' Choice status to any product that was copy-protected ("The Great Windows Software Scandal," May 26, 1992). But in the August issue of *PC Magazine*, the copy-protected Mathematica for Windows is an Editors' Choice. Have you abandoned the cause you once fought for?

Robert J. Sandler
New Milford, New Jersey

• Bill Machrone said that *PC Magazine* created this policy "back in the bad old days." Since then, copy protection has for the most part faded away nicely, except in some very expensive, high-end programs. Despite its copy protection, Mathematica for Windows (along with Maple V) stood out among symbolic math programs and richly deserves its Editors' Choice distinction.—Ed.

DOS KNOWS MICE

I'm tired of seeing ads associating DOS with a keyboard and Windows with a mouse. DOS applications were supporting the mouse long before the first window was ever opened. Let's not forget that Windows can't do anything without good old DOS. The world needs a 32-bit menu-driven DOS—not a wasteful, power-hungry operating environment.

Haim E. Arazy
New York, New York

A WELCOME NEW DEVELOPMENT

I wanted to tell you how pleased I was to see that you formed a separate staff to review applications development software. Your new comparisons will fill a void. Keep up the good work.

Tom Wnuk
Milwaukee, Wisconsin

NO SUPPORT IN SINGAPORE

It seems that Microsoft Singapore is only interested in supporting Microsoft products sold in Singapore. I bought my copy of Windows from the United States (it was cheaper this way), but Microsoft Singapore refused to offer support. IBM Singapore, however, offers support for its software (OS/2 especially) no matter where it was purchased. That's what I call service!

Alvin Tan
Republic of Singapore

MORE ON MAGNET

In your cover story on 486/33 file servers (March 17, 1992), you provided a great service to your readers by making the spreadsheet file used in the price/performance index available on PC MagNet. Don't stop there. Please provide us with the same service for all surveys, especially the 1992 *PC Magazine* Service and Reliability survey.

A. L. Jagoe
Ferney-Voltaire, France

MORE PERFECT PC PRAISE

The July 1992 cover story, "The Perfect PC," is the best article *PC Magazine* has ever published. It fully represents the heart of what you do best for your readers. Although it is wide in scope, the article has a perfect balance of breadth and depth. I am going to use it as my guide when I am ready to purchase my next system.

Tony Woo
San Jose, California

CORRECTIONS AND AMPLIFICATIONS

The CorelDRAW image on the cover of the August 1992 issue was created by Arizona artist Peter McCormick.

HOW TO WRITE TO PC MAGAZINE

We welcome your comments, insights, and suggestions. Please send correspondence to Letters, *PC Magazine*, One Park Ave., New York, NY 10016, or upload it to PC MagNet (see page 12 for access information). All letters become the property of *PC Magazine* and are subject to editing.

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CIRCLE 063 ON READER SERVICE CARD

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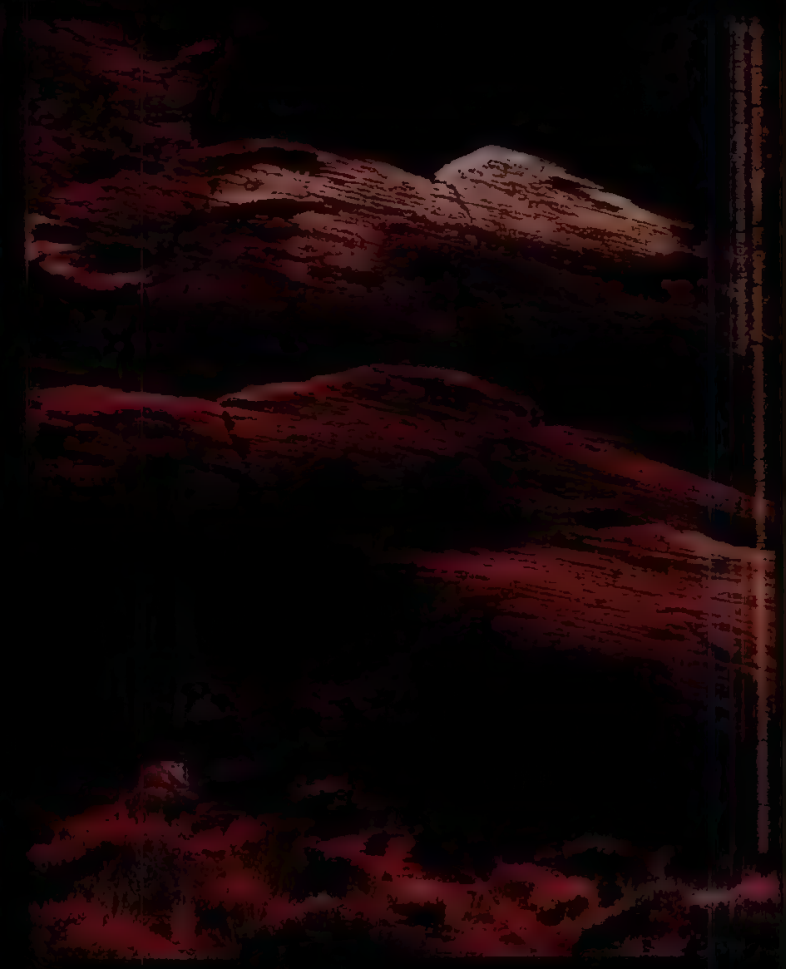

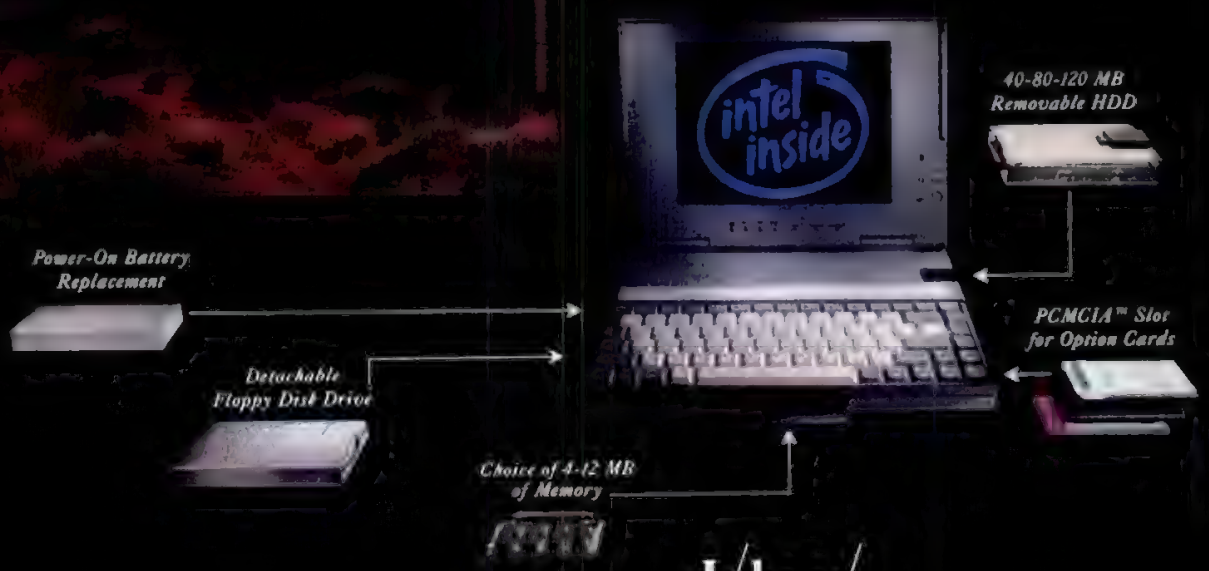

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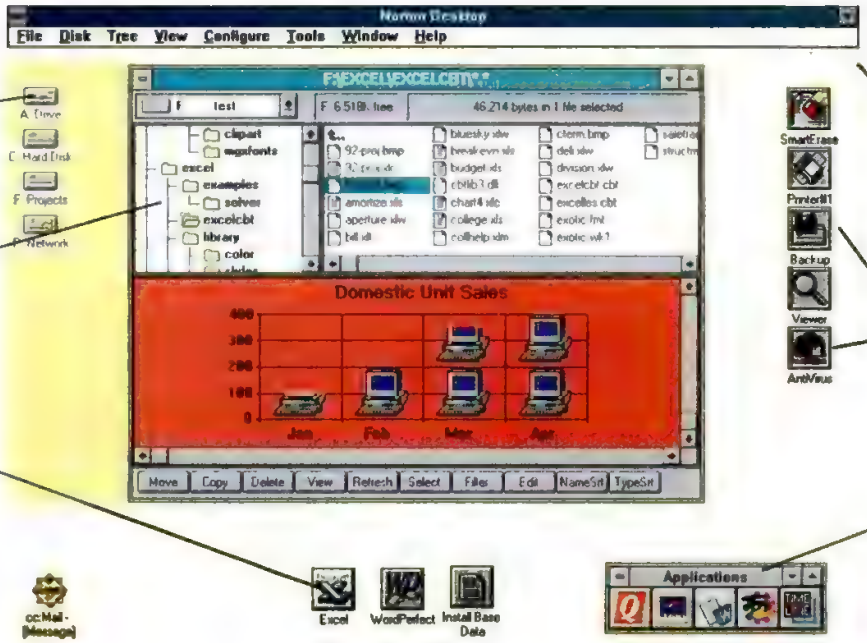
With Norton Desktop for Windows, your drive icons sit right on the desktop, so you get direct access to your files.

Click on a drive icon for easy file management. The drive window includes a tree pane, file pane, and a customizable button bar with a view option.

For total convenience, applications or files can be dragged onto the desktop for easy access. Open files effortlessly with a quick mouse click or, by dragging the file to the application.



The Norton Desktop is a completely integrated environment. You can drag-and-drop files from the drive window to a tool, drive icon, application, or onto the desktop itself.

All the utilities you need to backup, protect, and repair your data sit right on your desktop. You can drag files or drive icons directly to the tool you need.

Keep your favorite applications in a handy customizable toolbox. Launch the application easily with just a click of the mouse.

That's a package full of savings. Norton Desktop for Windows 2.0 enhances Windows in all the important ways. It helps you work faster, smarter, and with better results.

Saves Time.

Something you don't have a lot of. We've improved file management, placing drive icons right on the desktop, so you get immediate access to all your files and applications. Speed search, button bar, viewer, customizable fonts, and collapsible tree structure are all designed to save you time. Full drag-and-drop allows you to drag applications and files out of the drive window to anywhere on the desktop so you have instant access to them.

Saves Money.

We all know time is money. And because Norton Desktop looks so much like Windows, you won't have to waste time learning how to use it. You get most everything you need to run your PC in one comprehensive package—a great, money-saving value.

> "Norton Desktop for Windows 2.0 is still one of the best productivity tools you can buy."
> —*PC Computing*, 5/92

Saves Energy.

Because Norton Desktop can be easily customized, you invest your energy in your work, not in trying to figure out how to get it done. Customizable auto-load frees you from reloading applications that you use daily. And, SuperFind™ allows you to locate "lost" files, across networks or in the background.

Saves Data.

Lost or corrupted data can cost you time, money, and energy. The selection of utilities in Norton Desktop helps you maintain your data. Virus protection and repair, automatic backup, and data recovery can be easily accessed from the desktop; or, scheduled to run unattended, or in the background. Plus, they support all major networks. Norton Desktop for Windows 2.0 is just $179.00 (S.R.P.) at your dealer. Or, call **1-800-554-4403** for an instant FAX Data Sheet (enter 450) .** The sooner you get it, the sooner you'll save.

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CIRCLE 344 ON READER SERVICE CARD

DR DOS Lives in NetWare

Giants vie for peer-to-peer LANs

Microsoft's move to put networking into three versions of Windows is a full-scale assault on Novell's lock on the networking market. But don't expect Novell to give in without putting up a fight.

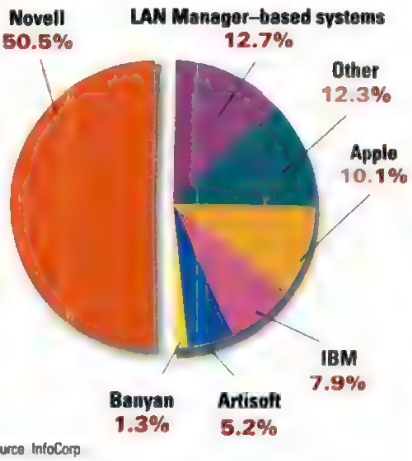
Last year, when Novell bought Digital Research, maker of DR DOS, it picked up single- and multiuser versions of Digital's DR DOS. DR DOS, long known as an alternative to Microsoft's MS-DOS, had garnered only a fraction of the DOS market even though it pioneered features and utilities that Microsoft eventually put into MS-DOS.

Novell's motives are clear: It plans to integrate DR DOS into its network operating systems much the way Microsoft plans to incorporate MS-DOS and networking into Windows. Both companies' strategies mean that network users won't have to install two operating systems.

So what about a new standalone version of DR DOS? Maybe next year, says Novell. DR DOS is now an integral part of Novell's NetWare Desktop Systems Group, and Digital Research has been assimilated into Novell. Novell's priorities are exactly what you'd expect from a network operating system company: Shore up the key product line and storm the desktop. DR DOS can wait.

Novell Protects Network Turf

1991 installed base of LAN operating systems



Source: InfoCorp

Novell intends to remain on top in part by integrating DR DOS into NetWare.

First up will be NetWare Lite with DR DOS integrated into the operating system and full Windows 3.1 support. The current version of NetWare Lite 1.1, which is available bundled with DR DOS, has no built-in Windows support. NetWare Lite will fight it out with Windows for Workgroups 3.1 and Artisoft's LANtastic for the peer-to-peer networking users who want to connect small workgroups.

Next, look for DR DOS in NetWare PalmDOS. PalmDOS is Novell's networking entry in the smaller-than-a-bread-box category to compete against operating systems from Apple, GO, and Microsoft. The only problem is that it doesn't have a pen interface, while the others do.

NetWare 4.0, Novell's top-of-the-line server-based operating system, is expected by the end of the year. NetWare 4.0 won't replace 3.*x*, but will be targeted to blunt Microsoft's early 1993 introduction of LAN Manager for Windows NT 3.1.

—*Christopher Barr*

High Speed Comes To PCMCIA Slot

IF YOU'VE BEEN FRUSTRATED BY the lack of PCMCIA cards for your notebook, you may be in for a treat. This fall, high-speed fax modems and LAN cards for the credit card–size Personal Computer Memory Card International Association expansion card should proliferate.

Today, the fastest modem you can buy for the slot operates at 2,400 bps, but AT&T Paradyne has developed a V.32bis data and fax PCMCIA modem that will run up to 14.4 kilobits per second. The company, which makes the Comsphere V.32bis modem that won an Editors' Choice in the March 17, 1992, issue of *PC Magazine*, is currently shipping its KeepInTouch Card to notebook and palmtop makers. Eventually, the company plans a wireless version that would work with RAM Mobile Data's Mobitex packet-radio network.

Rockwell International is currently shipping a V.32bis data and fax PCMCIA chip set to modem manufacturers. Megahertz Corp. will be selling end-user products based on the chip set by the Fall Comdex trade show in November (800-527-8677).

At four times the speed of today's roughly $300 2,400-bps modems, the new high-speed modems are expected to sell for between $500 and $600, depending on the feature set. Also available this fall for the PCMCIA slot will be Ethernet adapters from Xircom (818-878-7600) and New Media Corp., which will also be selling a SCSI II controller (800-453-0550).

—*Mary Kathleen Flynn*

Managing Software Site Licenses

MOST CORPORATIONS WANT TO do the right thing when it comes to managing software site licenses over the network. But network administrators haven't always had the right tools. That will soon change. Over the next year, you'll see standard hooks for site license management embedded in many applications, as well as in the

Pipeline *By Gus Venditto*

Look-and-Feel Chilling Effect Past

The sword of the "look-and-feel" lawsuit has been hanging over the PC development community for over four years now—ever since Lotus charged Paperback Software, Mosaic Software, and The Santa Cruz Operation with stealing the Lotus 1-2-3 command structure. Those three companies quickly bowed to the threat of protracted litigation and settled with Lotus, withdrawing their products from the market. Borland, however, challenged Lotus head on, introducing Quattro Pro with a 1-2-3 command structure, knowing that a lawsuit was likely and confident that it was in the right.

After several years of legal exploration, Lotus was recently upheld in a summary judgment that is unlikely to be the last word. Borland has vowed to fight on, and Lotus is likely to keep up until the case reaches the Supreme Court. Back when Lotus began its effort to establish the 1-2-3 command structure as intellectual property, heated discussion of the impact of a Lotus victory took place in these pages and in other business journals. The consensus was that a Lotus victory would have a chilling effect on innovation.

PHOTOGRAPH BY PETER GREGOIRE

Now that Lotus has its first real victory, it's clear that a chilling effect has already taken place. Not only have companies stopped advertising their "Lotus-like" interface (cutting back extensively on free publicity for the Cambridge firm), no developer has even gone near the simple, topside menu structures that 1-2-3 first popularized without making obvious efforts to be different (and, as a result, making the products more difficult).

Like so many other trends in recent years, the net result of this careful approach to interface design has been a boost to Windows and OS/2, whose look and feel is freely available and thrust at developers as an ideal command structure.

It's hard to see the Borland decision having much effect after all this time. It may make a few more developers confident that they can publish and promote a new design. But it's hard to imagine any company timid enough to rely on the protection of the U.S. justice system having the stamina and deep pockets to market a proprietary approach to software design successfully. The recent judgment is very much an anticlimax, since virtually every software company regards litigation as such an onerous burden that it will go to great lengths to avoid being drawn into it.

It's clear now that the lawsuit did put a brake on the free exchange of ideas that was characteristic in the early days of the PC, simply because the chance that a technological dispute can get a fair hearing in a courtroom today seems very remote. If Borland is ultimately victorious, which seems likely, the climate will be so different that the issue of protecting a command structure will almost certainly be irrelevant by the time the Supreme Court rules. The effect that this case is most likely to have in the future is to demonstrate that the country needs new rules for protecting software design that go well beyond today's copyright and trademark protections.

Gus Venditto is a contributing editor to PC Magazine *and editor of* PC Sources.

SiteLock helps network administrators honor their software licensing agreements.

NetWare and Windows environments.

Without a management tool, a network administrator has a tough and tedious time ensuring that the company is in compliance with its software licenses: Nothing short of walking around and manually checking each user's system is required. Even then, there's no way to monitor (or, to use the industry term, to meter) usage trends. While some network managers may have looked the other way in the past, today the Software Publishers Association is hot on the heels of software pirates: The SPA says that it recovered more than $3 million in settlements during its fiscal year, which ended in June.

Concerned about the loss of revenues, software developers recently got together to tackle the problem. A consortium that includes Brightwork Development, DEC, IBM, Lotus, Microsoft, and Novell created a standard application programming interface (API) called the Licensing Service API. Network management tools are expected to support the LS API as early as this fall, and shrink-wrapped applications that support it should appear early next year, according to Brightwork president Greg Gianforte. Ultimately, you should expect to see the LS API built into operating environments such as NetWare and Windows (through WOSA, the Windows Open Services Architecture).

In the meantime, there are several network tools that will help you monitor and manage your licenses. For NetWare LANs, there's SiteLock from Brightwork (800-552-9876) and AppMeter from Funk Software (617-497-6339); for DOS-based LANs, there's Saber Software Corp.'s Saber LAN Administration Architecture (800-338-8754), and for LANtastic networks, C & D Programming recently announced AppTrack (516-434-3214). Several metering utilities are available on the NovLibrary forum on CompuServe: LIMIT.ZIP, METER.ZIP, LK110.ZIP, LOGCPY.ARC, and XMETER.ZIP. And the accounting firm Deloitte & Touche recently launched a service that will help you develop a company-wide infrastructure to manage hardware and software inventory and use (206-292-1800).—*Mary Kathleen Flynn*

Cyrix to Enter Upgrade Game

WHILE INTEL IS CONCENTRATING most of its upgrade strategy on 486 (SX and DX) owners with its so-called clock-doubling OverDrive products, competing chip maker Cyrix will soon go after owners of 386 PCs. Cyrix is betting that many corporate customers, who have grown increasingly cost-conscious in today's slow-growth economy, will prefer to replace their old CPUs (at a cost of around $300) rather than their entire systems (at a cost of $2,000 to $3,000).

Cyrix's precise product and distribution

plans are not finalized, but the company has demonstrated its technology at the PC Expo trade show in June and is launching a corporate beta test program this fall. The goal of the upgrade product is to give clock-doubled 486 performance to 386DX PCs.

It's not clear yet whether Cyrix will sell products into the retail channel, as Intel has done with its OverDrive CPUs, or only directly to large corporate accounts (with sales in the thousands of units), but Cyrix says it plans to explore new channels early next year. (Cyrix will respond to written requests for information. Send faxes to Mike Bruzzone at 214-699-9857.)

Meanwhile, Intel offers 386 owners the $299 RapidCAD, a two-chip set that provides enhanced floating-point math capabilities and is sold in stores.
—*Mary Kathleen Flynn*

Top Retail Software

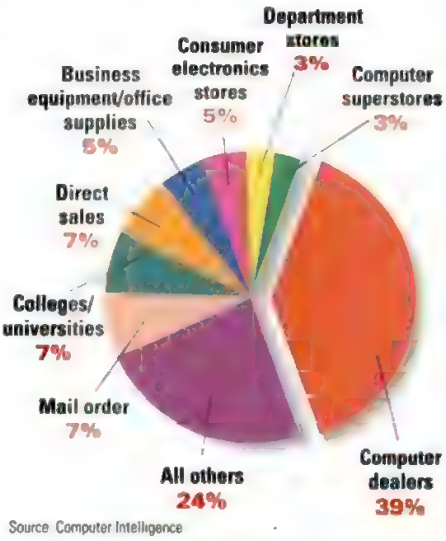
Current ranking	Last issue	Product/ company
1	9	**Microsoft Windows 3.1 Upgrade** *Microsoft Corp.*
2	—	**Procomm Plus for Windows** *Datastorm Technologies*
3	1	**WordPerfect 5.1 for DOS** *WordPerfect Corp.*
4	3	**Microsoft Windows 3.1** *Microsoft Corp.*
5	4	**Microsoft DOS 5.0 Upgrade Kit** *Microsoft Corp.*
6	10	**Procomm Plus 2.1** *Datastorm Technologies*
7	2	**QEMM-386 6.0** *Quarterdeck Office Systems*
8	7	**Stacker 2.0** *Stac Electronics*
9	14	**Word for Windows 2.0 Upgrade** *Microsoft Corp.*
10	—	**Office for Windows 2.5** *Microsoft Corp.*
11	5	**WordPerfect 5.1 for Windows** *WordPerfect Corp.*
12	6	**Lotus 1-2-3 2.4** *Lotus Development Corp.*
13	—	**Excel for Windows 4.0 Upgrade** *Microsoft Corp.*
14	13	**Word for Windows 2.0** *Microsoft Corp.*
15	—	**WordPerfect Windows Trade Up** *WordPerfect Corp.*

The list ranks PC business programs according to the total number of copies shipped to stores and resellers in the week ending August 8, 1992. The list is based on shipments to more than 12,000 retail locations. It does not include sales made directly by software publishers and cannot be interpreted as a picture of the entire software market. Sales information compiled by Ingram-Micro.

Kiss List Prices Goodbye?

INFLATED LIST PRICES MAY ONCE have given customers a point of comparison, as well as the illusion they were getting a good deal. But in today's multichannel marketplace, many hardware vendors say that list prices have become misleading at best and meaningless at worst. Two such vendors are Compaq and NCR, who are veering away from list prices.

The list price is a function of the two-tiered distribution strategy used by many PC manufacturers. It reflects the cost to the dealer plus a high markup. But almost all dealers discount heavily, and end users generally pay 25 to 40 percent off the list price.



1991 PCs sold in the U.S., by distribution channel.

While imperfect, the list price strategy worked fairly well until mail-order houses—which sell directly to end users and therefore don't use list prices—became a major force in the PC market. Recently, some direct marketers, including Dell, have begun to pit their low selling prices against the inflated list prices. Adding to the problem, some publications, including this one, have printed the two types of prices alongside one another.

Some companies are fighting back. "It's time to tell customers what they'll pay for the product," explains Bruce Langos, director of strategic planning and marketing for NCR's workstation product division. Today NCR representatives will quote you a "net" price, which could be 30 to 40 percent below what was once a list price. The purpose behind such pricing, Langos says, is to create a level playing field on which to compare PC products.

Compaq is also exploring new pricing models. In Europe, Compaq has already established a "typical buying price," which spokesperson Mike Berman describes as an average of prices from dealers. In the U.S., Compaq is not providing list prices for its new low-end ProLinea line of PCs; it is leaving pricing entirely up to its dealers.

Microtek Lab, which makes color scanners and other graphics products, may not go that far, but the company is adjusting the prices it gives to dealers to reflect street prices better. Woody Hale, vice president of sales and marketing, believes this strategy will eliminate "apples-to-oranges comparisons."

The distinction between list and street prices is blurring in the software industry as well. With software vendors offering inexpensive upgrades to their own products and competitive upgrades to other vendors' products, and with software dealers offering significant discounts, the $495 list price for a GUI word processor means very little today. Scott Oki, former vice president of U.S. sales and marketing for Microsoft, calls suggested retail prices "historical baggage." Oki believes that software vendors should price their products using the cost-plus-margin model that dealers employ.

But list prices aren't likely to disappear entirely—not until the whole industry moves towards "net" pricing and not until customers stop believing that a higher list price equals more features. And vendors would be ill advised to abolish list prices without replacing them with a more realistic tool for buyers.—*Brad Grimes*

Virus Spread: Who's to Blame?

IT MAY BE EASY TO CONDEMN THE creators of computer viruses—though finding the culprits is no easy feat—but it's hard to know who's at fault for spreading a virus.

Most computer virus laws are aimed at those who create and knowingly disseminate the dastardly self-replicating computer mites. Under federal law (which concerns only government-owned computer equipment), creating and deliberately propagating a computer virus is a felony. All states except Vermont have computer crime laws, but few provide for any civil liability.

Some industry leaders and legislators are calling for sweeping changes in the federal virus laws, though. Earlier this year, J.J. Buck BloomBecker, director of the National Center for Computer Crime, suggested a new set of computer crime guidelines, including civil action. Illinois congressman Wally Herger has proposed an amendment to the federal government's Computer Virus Statute, entitled the Computer Virus Eradication Act of 1989. If passed, it would let virus victims bring civil suits against the virus creator and propagator. Although this bill has since languished in Congress, Herger's press secretary, Roger Mahan, says it may be revised and reintroduced in another session of Congress.

Perhaps the most difficult case to prove would be one against an "enabler," such as the so-called Dark Avenger, who recently offered a virus developers' kit (called the Mutation Engine) on a public electronic bulletin board. Without creating or spreading a virus, is he breaking the law? Probably not. As Mahan points out, "People in physics can develop destructive mechanisms but they don't use them. So have they done anything wrong?"—*Lance Ulanoff*

Database Hooks

AS DATABASE TECHNOLOGY grows more ubiquitous, applications will become more database-savvy with easy-to-use querying tools, transparent access to data, and rich database capabilities.

Borland's new spreadsheet, QuattroPro for Windows (QPW), offers some of the most robust database support to date. QPW includes Database Desktop, a table-based querying tool. The Database Desktop looks like Paradox's Query By Example (QBE) but gives you access to data stored by databases other than Paradox. The Database Desktop lets users read and write database files and be "good database citizens" by honoring data integrity rules, such as shared access to data and record locking.

Microsoft Excel is already bundled with Q+E, a querying tool for dBASE and SQL data. Now that Microsoft is going full force into the database market with FoxPro and with its upcoming Windows database, Access (which was code-named Cirrus), it's inevitable that Microsoft's apps will gain tighter integration with its databases. And with both Borland and Microsoft pushing database interoperability, powerful database hooks are likely to show up all over the place.—*Mary Kathleen Flynn*

Keyboard PCs Save Space

MORE CRAMPED THAN COZY, YOU sit behind a 2- by 4-foot desk, sharing what little room you have with a computer, a monitor, and a keyboard for at least 8 hours a day. Your legs are cramped because you are forced to keep everything you need beneath your desk. The next time you bump your knee, you may be tempted to try a keyboard PC.

A handful of companies have recently built fully capable computers inside a standard-size PC keyboard: DataBusiness Systems (800-989-1330), Rightpoint Electronics (800-769-6972), Advanced Interlink Corp. (714-894-1675), New World Technologies (800-443-8885), Aamazing Technologies (800-989-1330), and Linksys (800-326-7114). For less than $2,000, the current PC keyboards offer users 25- or 33-MHz 386SX power and hard disk storage up to 120MB in a small, light (under-10-pound) package.

They don't offer a lot of expandability, but that's probably a safe tradeoff since most will be used as network workstations. And although some companies are touting keyboard PCs as alternatives to portable PCs (and they are indeed portable), their lack of a monitor and their lack of a truly small form factor make it unlikely that they will give laptops much competition.

Rightpoint Electronics' Netpoint SX houses a 386SX-based computer inside a keyboard.

Where keyboard PCs make the most sense is in point-of-sale environments, such as car rental and airline ticket counters, or other heavy data-entry situations. That's where the full-size keyboards and compact size of these machines will be fully appreciated.—*Tin Albano*

Briefs

YOU MAY BE ADEPT AT choosing the best business software, but do you know how to pick the right PC products for your kids? If you need some help, try a parents' computing guide. Due shortly is *Parents, Kids & Computers,* written by *PC Magazine* executive editor Robin Raskin and frequent contributor Carol Ellison (Random House, 1992). Already published are *Kids & Computers: A Parent's Handbook* by Judy Salpeter (Sams, 1992) and *The Parent's Guide to Educational Software* by Marion Blank and Laura Berlin (Microsoft Press, 1991). Or call educational publisher Edmark Corp. for a free pamphlet, *Parent's Guide to Educational Software for Young Children* (206-861-8200).

MANY OF THE NEW ergonomically sensitive designs for keybords separate the left and right halves of the board, but inventors Jeffrey Spencer and Stephen Albert are going one step further. They're going vertical. Their aptly named Vertical keyboard is designed to sit in your lap or on a desktop. It places the left and right halves of the keyboard at your sides, letting your hands stay in a relaxed palms-in thumbs-up position without twisting your arms or wrists. Spencer and Albert are still negotiating with manufacturers (619-454-0000).

NOTEBOOK AND SUBNOTEBOOK makers that want to build the PCMCIA slot into their products will soon have a new choice when it comes to the host adapter: Cirrus Logic is developing adapter chips that will support one or two PCMCIA peripherals. Cirrus expects its new chips to beat Intel's current offerings on performance and power consumption (510-623-8300).
—*Mary Kathleen Flynn*

Photograph by Enrique Cubillo

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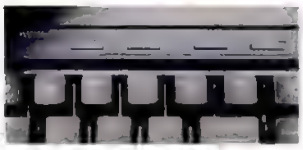

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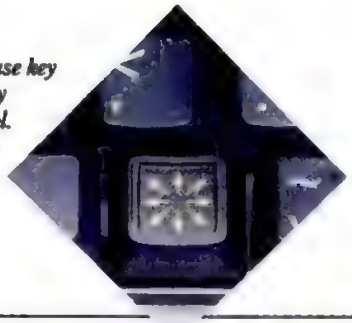

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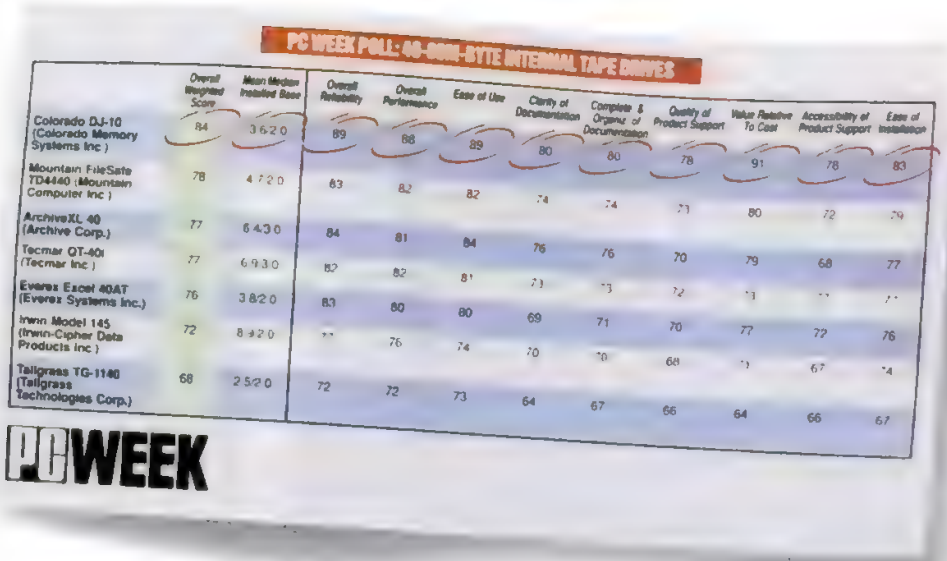

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	Overall Weighted Score	Mean Median Installed Base	Overall Reliability	Overall Performance	Ease of Use	Clarity of Documentation	Complete & Organized Documentation	Quality of Product Support	Value Relative To Cost	Accessibility of Product Support	Ease of Installation
Colorado DJ-10 (Colorado Memory Systems Inc.)	84	3,620	89	88	89	80	80	78	91	78	83
Mountain FileSafe TD4440 (Mountain Computer Inc.)	78	4,720	83	82	82	74	74	73	80	72	79
ArchiveXL 40 (Archive Corp.)	77	6,430	84	81	84	76	76	70	79	68	77
Tecmar QT-40i (Tecmar Inc.)	77	6,930	82	82	81	73	73	72	[illegible]	[illegible]	[illegible]
Everex Excel 40AT (Everex Systems Inc.)	76	3,820	83	80	80	69	71	70	77	72	76
Irwin Model 145 (Irwin-Cipher Data Products Inc.)	72	8,920	[illegible]	76	74	70	70	68	[illegible]	67	74
Tallgrass TG-1140 (Tallgrass Technologies Corp.)	68	2,520	72	72	73	64	67	66	64	66	67

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First Looks

HANDS-ON EVALUATIONS OF THE NEWEST SHIPPING PRODUCTS

■ **Fast Gets Faster on the Desktop**

First 66-MHz Systems Show Their Blazing Speed

BY JOHN R. QUAIN

The king is dead; long live the king. Just a year after its introduction, Intel's 50-MHz i486DX CPU has been usurped by a new PC monarch, its 66-MHz i486DX2. Judging by the first three 66-MHz systems to reach PC Magazine Labs, users will be pleased to discover that the new CPU fulfills most of its performance promises, without raising taxes.

In processor and memory tests, the three systems reviewed here deliver a 15 to 25 percent performance gain over straight 50-MHz PCs—for $100 to $300 less. The fastest of the three in PC Labs' processor and memory tests is the $2,999 Expo DX2-66 from Expo Tech Computers. Advanced Logic Research's $2,499 ALR Flyer 32DT 4DX2/66 is close behind, with the most expensive of the three, Dell Computer's $3,969 466DE, trailing.

The centerpiece of all three systems is Intel's 66-MHz 486DX2, which uses the same so-called clock-doubling technique that brought us the 50-MHz 486DX2. The 66-MHz version is based on the same 32-bit 486 processor logic with its internal math coprocessor, 8K internal memory cache, and submicron, three-layer design (the 33-MHz 486DX takes a one-micron, two-layer approach).

The main difference is that the new DX2 CPU runs at 66-MHz internally while communicating with local bus components—system control logic and memory—at 33-MHz. The two speeds offer a two-fold benefit. First, instructions get processed internally faster than on any other 486 available. Second, the slower 33-MHz external speed allows PC makers to turn mature 33-MHz 486DX motherboards into 66-MHz DX2 motherboards without incurring the cost of the faster system board components required by full 50-MHz systems.

SLIMLINE: *ALR's Flyer 32DT 4DX2/66.*

ALR FLYER 32DT 4DX2/66

Aimed at corporate users with restricted real estate and little need for expansion, the $2,699 ALR Flyer 32DT 4DX2/66

• *Continues on page 38*

IN FIRST LOOKS

FAXability Plus/OCR 42
PowerToolboxes 44
Dell 320SLi subnotebook 46
DECwrite 48
ProjectGuide 49
Diamond Speed Star 24X . 50
U.S. Robotics Palmtop WorldPort 50
Commence 56
Gpf 58
3D Workshop 61
EDOS 61

■ **Statistical Software**

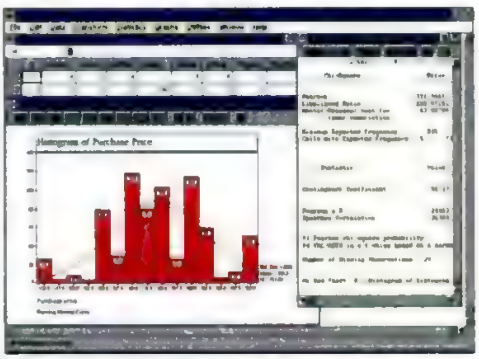
SPSS for Windows: Stats Power with GUI Interface

BY JAMES KARNEY

The probability that the average PC user will have fun working with statistics is not very high, but odds are that SPSS for Windows, Release 5.0, will surely make statistics tasks a lot more pleasant.

Those familiar with the older character-based code-driven versions of SPSS for UNIX and DOS from SPSS will find much to like with this release's mainframe features and Windows ease of use: dialog boxes, charting abilities, and easy data import and export with major spreadsheets.

Like the mainframe versions, SPSS for Windows has several modules you can buy separately. Only the Basic ($695) and Professional ($395) modules were available for this review, with six others due within the next few months. When the Windows version is complete, it will offer all the analysis tools provided in the mainframe versions.



VIEWS: *SPSS for Windows makes it easy to compare a graph to original data.*

The Basic module is required to run the others and includes the primary user interface, Data Manager, Chart Editor, and Report Writer. You can perform summary and means comparisons, frequencies and crosstabs (both with multiple responses), t-tests, one-way ANOVAs, and linear regressions.

The Professional module adds cluster, multidimensional scaling, proximity, and reliability, as well as factor and discriminate analysis. The planned additions include the SPSS Advanced Statistics, Tables, Trends, Categories, CHAID, and Lisrel (linear structure) modules. These new features will be automatically added to the existing basic menus during installation, so there is no need to shift from

• *Continues on page 40*

66-MHz

CONTINUED FROM PAGE 37

comes in a slimline case (3.9 by 16.5 by 15.8 inches, HWD), with an Epson 1.44MB floppy disk drive and room for one more accessible device. It does cost substantially less than the other two machines reviewed here, but the ALR comes with less memory, less room for expansion, and a smaller hard disk.

The model we tested used a 200MB Western Digital IDE drive. Our test unit also came with an optional $395 256K SRAM cache installed. Adding 4MB of additional memory (at $69 per megabyte, maximum of 36MB) to match the other configurations brings the ALR Flyer 32DT 4DX2/66 up to $3,370, about $370 more than the Expo Tech, but still more than $600 less than Dell's EISA model.

ALR's optional 25-nanosecond direct-mapped write-back cache aided in securing good processor and memory test scores; the ALR came in ahead of the Dell PC and was comparable with the Expo Tech machine. However, without the aid of software caching, ALR's hard disk could not match the speed of Dell's IDE drive.

ALR's compact internal design is achieved by integrating several components on the system board and planting three 16-bit ISA expansion slots horizontally in the case. An upgradable 32-bit CPU card and the external cache have their own slots, with a proprietary 16-bit slot also available for ALR options. The hard disk's IDE controller, floppy disk controller, and the system's I/O ports (two serial, one parallel, and a mouse port) are integrated into the system board. Everything runs under the aegis of an upgradable Flash EPROM using a Phoenix BIOS. The BIOS setup allows users to adjust various parameters, including setting a system password.

The ALR's video is handled by a motherboard-bound Western Digital WD90C31 video controller, which boasts a hardware cursor and 1MB of DRAM display memory. It performed well in VGA tests, but was not up to the Windows speed of the ATI board featured in the other two machines. Furthermore, the PC's 800-by-600 noninterlaced 14-inch monitor is not quite a match for the 1,024-by-768 video controller.

COOL: *The Dell 466DE has an extra fan.*

• List Price: *ALR Flyer 32DT 4DX2/66 with 4MB RAM, 200MB hard disk, Western Digital WD90C31 video controller, 14-inch noninterlaced 800-by-600 monitor, DOS 5.0, Microsoft Windows 3.1, $2,699. Advanced Logic Research Inc., 9401 Jeronimo, Irvine, CA 92718; 800-444-4257, 714-581-6770; fax, 714-581-9240.*

Circle 431 on reader service card

DELL 466DE

Trailing in the performance polls, the $3,969 Dell 466DE EISA desktop system (6.3 by 16.7 by 16 inches, HWD) comes with a dual 1.44MB/1.2MB Canon floppy disk drive and room for two additional accessible half-height devices. Quick release thumb screws at the back of the case let you inside the machine, where you'll find 8MB of RAM (upgradable to 96MB, $199 per 4MB) and six EISA expansion slots (one occupied).

The 466DE uses a proprietary 32-bit CPU module. Not only has Dell gone to the trouble of installing a precautionary heat sink on the CPU—as have ALR and Expo Tech—but it has also installed a small fan across from the CPU

A Smooth Ride on Route 66

The route to 66-MHz power looks like a smooth road for both PC vendors and PC users, though there are a couple of signposts you should be aware of.

The main advantage of the 66-MHz 486DX2—besides faster processing speed—is that the CPU doesn't require an expensive upgrade in support chips. Unlike straight 50-MHz 486DX designs, connections to the system memory (DRAM), external cache memory (SRAM), the system BIOS, and controller logic can be left pretty much the same on a 66-MHz DX2 as on a 33-MHz DX machine.

IS HEAT A FACTOR?

Fast 50-MHz processors initially raised heckles about heat. The real concern, however, was about the potential signal propagation problems with chips in the immediate vicinity of the CPU. By keeping that speed at 33 MHz, the 66-MHz DX2 avoids another potential problem. It also turns out that all the talk about potential heat buildup in the chip isn't much of an issue, but to play it safe, most manufacturers have chosen the prudent path and installed heat sinks on top of the chip.

NOT QUITE PLUG AND PLAY

For all that, the 66-MHz DX2 isn't a PC maker's complete plug-and-play dream. To get the most from the chip, the system's memory architecture should be designed to handle the particular demands of a 66-MHz DX2 chip.

Unlike a regular 33-MHz 486DX, when a 66-MHz DX2 makes instruction calls to the local system bus, the requests occur internally at twice the 33-MHz speed of the bus. Even when the components on the local system bus can operate at zero wait states, this still creates two to three wait states in the processor, which is within acceptable limits. If the local bus introduces even one wait state of its own, however, it will cause four to five wait states in the processor.

Consequently, when instruction requests reach beyond the 66-MHz DX2's internal cache, performance suffers. Intensive database applications and transaction processing tasks are the programs that most commonly cause such so-called "cache misses." So for these jobs, it's particularly important to ensure that the PC's memory and controller logic introduce as few wait states as possible.

According to PC Labs' benchmark tests, a large, 256K write-back external SRAM cache will help alleviate such additional wait states, and in some designs, new control logic may be in order. The Dell 466DE system we tested, for example, used a write-through 128K cache and suffered in processor and memory tests as a result.—*JQ*

Benchmark Tests: 66-MHz Systems

The Expo Tech 486DX2/66, the ALR Flyer 32DT 4DX2/66, and the Dell 466DE—the first 66-MHz systems to arrive at PC Labs—all outperformed the average 50-MHz DX system on our processor test by more than 25 percent. Notice that disk and video performance are not necessarily improved by the processor's speed.

We used PC Magazine Labs' Hardware Performance Tests, Release 6.0, to measure each PC's processor, memory, disk, and video subsystem performance. The Graphics Winmark is the geometric mean of 12 Windows-based graphics tests from WINBENCH 2.5, weighted to reflect how frequently various functions are used

Higher scores represent better performance.	Processor (operations per second)	Memory (kilobytes per second)	Disk (kilobytes per second)	Video (thousands of operations per second)	Graphics Winmark (megapixels per second)
Expo Tech 486DX2/66 (486DX2/66)	705	10,544	147	3,045	10.47
ALR Flyer 32DT 4DX2/66 (486DX2/66)	703	10,418	130	4,793	8.43
Dell 466DE (486DX2/66)	684	10,365	217	3,281	10.09
486DX/50 average	514	8,017	352	2,605	6.09
486DX2/50 average	487	6,430	276	2,539	5.51

module for additional cooling.

The CPU module also has a 14-nanosecond 128K external SRAM cache. Using an Intel chipset, Dell's smaller write-through cache design was largely to blame for the system's lesser CPU and memory performance. (A larger cache option is not available.)

The 230MB Quantum IDE hard disk is responsible for the strong disk performance in this system. The Quantum drive has a 256K cache, which helped pull its disk scores in front of the other two 66-MHz machines.

Like the Expo Tech machine, the Dell system uses an ATI Graphics Ultra ISA video adapter. It deserves credit for the solid Windows performance and culpability for the slower DOS VGA scores. For display, Dell includes its own 14-inch UltraScan color SVGA monitor, capable of noninterlaced 1,024 by 768 resolution.

• List Price: *Dell 466DE with 8MB RAM, 230MB hard disk, ATI Graphics Ultra video adapter, 14-inch 1,024-by-768 noninterlaced monitor, DOS 5.0, Microsoft Windows 3.1, $3,969. Dell Computer Corp., 9505 Arboretum Blvd., Austin, TX 78759; 800-289-3355; 512-338-4400; fax, 512-343-3653.*

Circle 432 on reader service card

EXPO 486DX2/66

With the Expo 486DX2/66, you'll enjoy superior speed and have room to grow in this machines 24.8- by 8.7- by 18.5-inch tower case. There isn't quite the same level of integration or the array of well-turned out owner's manuals that the other two 66-MHz PCs offer, but everything you'll need is here, including Microsoft Works, Central Point antivirus software, and an internal 2,400-bps MNP 5 modem with a send fax. Together with included software, the modem allows Expo Tech support technicians to access your PC directly when problems arise.

Started by 14-year-old chip set maker Vtech Computers, newcomer Expo Tech opened for business last June. Expo Tech's Expo 486DX2/66 ISA PC is founded on a Vtech chip set and motherboard including an auto-sensing feature that allows you to add up to 56MB of SIMM RAM to the standard 8MB without setting a jumper or DIP switch ($45 per megabyte).

A 10-nanosecond 256K external SRAM cache was responsible for ExpoTech's excellent memory scores. The write-back, four-way set-associative cache design also helped performance, and the company claims its fast SRAM (laid out in socketed Motorola chips) allows for near zero-wait-state operation.

Expo Tech's Windows video performance was kept aloft by an ATI Graphics Ultra SVGA controller. Putting in approximately the same video times in Windows as the similarly outfitted Dell machine, both also lagged behind the ALR in DOS VGA video performance. Expo Tech complements the ATI card with a 14-inch Goldstar Super VGA monitor that is able to display 1,024-by-768 noninterlaced resolutions.

TOWER: *The Expo Tech 486DX2/66.*

Those shopping for a power workstation could do worse than the Expo DX2/66. It has eight 16-bit ISA slots (three occupied) and two 8-bit ISA slots. The tower case has six accessible drive bays, two of which are occupied by Chinon 1.44 and 1.2MB floppy disk drives.

Two half-height internal drive bays can be used for additional storage, with a 245MB Seagate 3283 IDE hard disk installed as standard. The Seagate drive didn't turn in eye-popping results, but a software disk cache should bring it up top speed.

SUPPORT AND SERVICE

Each of these three vendors offers additional options to entice you. Of the three, Dell has the most comprehensive array of add-in peripherals.

All three companies sell their machines direct to end users and bundle their systems with DOS 5.0, Windows 3.1, and a mouse. Each provides a one-year warranty and toll-free tech support, with Dell offering the longest support hours. All three also offer free on-site service for one year (ALR charges a $9.95 fee).

The bottom line on this initial group of 66-MHz 486DX2 PCs is positive. And until Intel's next-generation P5 processor is introduced next year, this class of machines is king of the performance mountain and a price/performance winner.

And there are plenty more systems to come. In the next edition of First Looks, PC Labs will test three more 66-MHz systems, from AST, Compaq, and Tri-Star. And right behind them, dozens more PC makers are quickly getting their 66-MHz systems ready for market.

• List Price: *Expo 486DX2/66 with 8MB RAM, 245MB hard disk, ATI Graphics Ultra video adapter, 14-inch 1,024-by-768 noninterlaced monitor, DOS 5.0, Microsoft Windows 3.1, Microsoft Works, and Central Point Anti-Virus for Windows, $2,999. ExpoTech Computers Inc., 113 McHenry Rd., Buffalo Grove, IL 60089; 800-284-3976; fax, 800-947-3976.*

Circle 431 on reader service card

SPSS

CONTINUED FROM PAGE 37

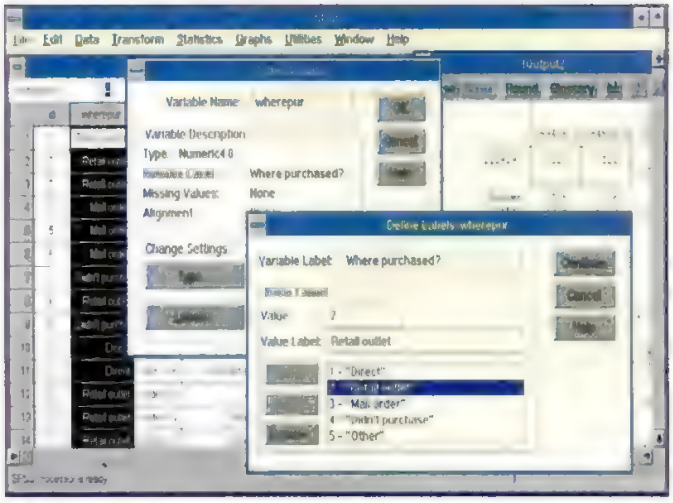
one module to another.

Installation is very straightforward, but this program eats up resources. You need to make sure that your Windows environment is set up properly, including a full swap file. Without it, we were hit with out-of-resource messages. To get the program running smoothly, we changed the Control Panel settings to match the suggested size for the swap file.

STATISTICALLY SIGNIFICANT GUI

If you've ever used SPSS on a VAX, you know it has a powerful engine but a primitive interface at best. The Windows version provides the same engine, but what a difference the GUI makes! Each primary function—data entry, charting, and so forth—has its own window and menu. Instead of using the proprietary command language, you can execute all commands through dialog boxes, with context-sensitive help and an online glossary. The option buttons are designed to keep all features no more than two layers from the menu or window level.

A good example of easy access is the data entry window, which looks and acts much like a spreadsheet. The ribbon spaces on the top of the column are used to define variables. Just double-click on one, and a dialog box offers all the tools needed for definition. You can display either labels or values in the cells, and you can enter and modify both at any time. A nested dialog box offers complete information on a variable and any annotations.



GUI STATS: *The Data Editor has full dialog box control and displays variables with labels and values.*

SPSS for Windows can also import ASCII, dBASE, Lotus 1-2-3, Microsoft Excel, Microsoft SQL Server, Oracle, and SYLK data directly into a data window. You can create templates to define variables automatically, which is helpful when creating a new data set or importing a data set.

MASSAGING THE DATA

The interface also makes it easy to massage data or recode variables without modifying the original set. For example, we reduced a range of age groups from six categories to two with just a few mouse clicks and a couple of keystrokes, used the new ranges to run several tests, and finally restored the original values. You can also write out the new ranges as an alternate file.

SPSS for Windows lets you run all tests and charts through the well-designed menus and dialog boxes. Dialog boxes are specific to the text involved: You choose the variables and let the program place them in the appropriate places. When everything is entered, click OK and the results appear in either the Output window or the Chart Editor.

SPSS veterans can still use all of the old command codes, and can record a dialog box session in the code to be run again in batch mode. Since the commands are in plain text, we were able to run routines that had been previously prepared to run on a VAX without any problems.

The Chart Editor is easy to use, with over 30 chart types: the usual bar charts, pie charts, and scatterplots, plus some 3-D versions that can be rotated on-screen. While SPSS may not have the range of presentation tools that can be found in dedicated charting programs, it is nevertheless well designed. We had no trouble pasting a graphic created in SPSS into FrameMaker or Microsoft Word for Windows.

The only real shortcoming is the limited formatting available in the Output window. While you can use any Windows font for charting, all results are displayed in a monospaced typeface. Of course, you can export your results into another program and dress it up, but this would require you to spend time fiddling with tabs and layout. SPSS Inc. plans to enhance the formatting tools.

ACCURACY AND SPEED

Accuracy and speed are two main concerns when you are working with numerical analysis. We tested the program on a 33-MHz 486 with 16MB of RAM, Windows 3.1 with 386MAX, and a variety of data sets from Excel 4.0 spreadsheets and other sets designed to evaluate statistical packages, such as the one listed in the *Journal of the American Statistical Association* (September, 1967, by J.W. Longley).

Longley's data has been verified on mainframes using a number of well-known programs, including SPSS. The sets varied in size from 300 to 50,000 cases (rows) and 5 to 15 variables (columns). The only errors we found were minor, such as one dealing with regressive squares that was off by about one part per billion when working with a six-digit variable.

Performance was quite acceptable, with most tests taking only 10 seconds or less for a data set containing up to 10,000 cases and 6 variables. In general, doubling the number of cases doubled processing time. More intensive calculations (such as running K-means clusters) took several minutes, but we were able to run them in the background while working in another application.

The documentation and optional reference books are well designed, and the tutorials use real-world examples to help you through life's tougher statistical problems. Still, you'll need to spend some study and practice time to discover all the program's features. The technical support staff is well versed in the program and well trained in statistical methods, and was even able to offer possible approaches to several analysis problems.

While some people may never think of statistics as easy, SPSS for Windows offers a solid engine with easy access to professional tools. SPSS Inc. is on the mark when it says its program provides "real stats, real easy." □

FACT FILE

SPSS for Windows, Release 5.0

SPSS Inc., 444 N. Michigan Ave., Chicago, IL 60611; 800-543-9262, 312-329-2400; fax, 312-329-3668

List Price: $695
Requires: 4MB RAM, 15MB hard disk space, Microsoft Windows 3.0 or later
In Short: An exceptional Windows version of a classic statistics package. Improved ease of use, data entry, and charting should make it popular with experienced statisticians and novices alike

N429 ON READER SERVICE CARD

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■ Communications

FAXability Plus: Smooth Faxing and Conversion to Text

BY DAVID DEJEAN

Intel's Personal Computer Enhancement Division (PCED) makes PC hardware, but its search for a more perfect union of PCs and faxes has led it in an unexpected direction—into the software business. PCED is shipping two versions of a Windows-based power faxer's instrument panel.

The $119 FAXability Plus is a flexible, well-designed toolkit that gives fax modem users a great deal of control over the creation and selection of cover sheets, logs, address books, group lists, and deferred-transmission schedules. For $249, FAXability Plus/OCR does all that and optical character recognition that turns uneditable faxes into editable text.

The occasion for Intel's entry into the software business is the debut of a new line of hardware that combines fax and data modems. But the FAXability software does not depend on Intel hardware. It works with equipment from most major manufacturers that is Class 1– or Class 2–compatible.

The FAXability packages make working with faxes feel very much like working with electronic mail. The FAXability desktop in Windows opens with the Inbox, a log of received faxes. Across the bottom of the screen are icons for the Phonebook and Outbox log, along with an indicator of fax modem status ("Idle" unless a fax is coming in). There's an icon bar across the top of the screen for actions that can be taken when a fax is selected in a log: View, Details, Forward, Reschedule, Save As, Print, Delete.

Just as you can fire off brief messages in e-mail, you can send short faxes by calling up a cover page and typing into the message field. FAXability allows up to 36 lines of text.

Longer documents created in other applications are sent from within those programs. FAXability works just like a Windows printer driver: Select it in Printer Setup, then select Print. The driver opens a dialog box for creating a cover sheet, then copies the document to a fax file and sends it off. The Phonebook maintains a list of fax addressees and numbers, and other information such as mailing addresses, voice phone numbers, and notes.

Another convenient feature of the Phonebook is Groups, which are mailing lists for faxes. Groups make it easy to send the same fax to several people, while scheduling features make it possible to defer fax transmissions to times when long-distance rates are low. FAXability takes advantage of Windows to transmit in the background, so you can continue working with your PC at the same time.

The best part is that all of this is configurable by the user. If you want a log that displays only unread faxes, you can create one. If you want to work with multiple Phonebooks, you can set them up. If you want to personalize the graphic on the cover sheet, you can do it. You're in control in ways that few fax applications allow.

FACT FILE

FAXability Plus, FAXability Plus/OCR

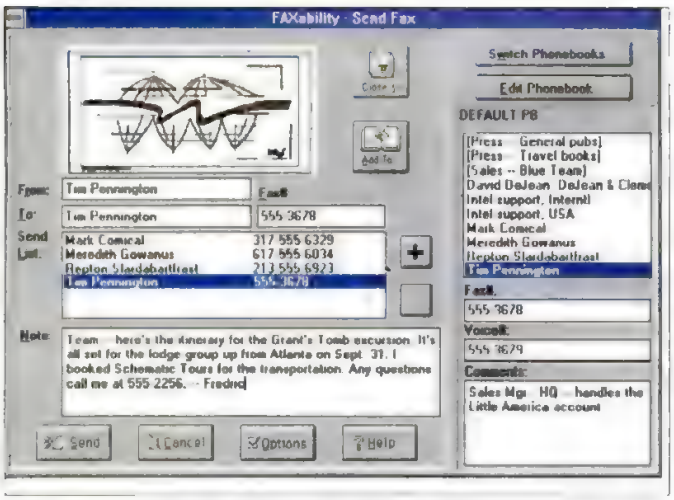
Intel Corp., Personal Computer Enhancement Division, 5200 N.E. Elam Young Pkwy., Hillsboro, OR 97124; 800-538-3373, 503-629-7000

List Price: FAXability Plus, $119, FAXability Plus/OCR, $249

Requires: 2MB RAM (4MB for OCR), 2MB hard disk space (6MB for OCR)

In Short: Intel's fax software is well crafted to be as unobtrusive as possible. The OCR version is easy to use, though not as full-featured as more expensive packages.

418 ON READER SERVICE CARD



OUTGOING: *FAXability Plus's Send Fax screen makes it easy to set up and send faxes to an individual or a list.*

FAXABILITY PLUS/OCR

FAXability Plus/OCR is even more like an e-mail package because the end product is the same as an e-mail message or an attached file and not at all like a fax; it's editable, usable text.

FAXability Plus/OCR wisely does not push the still-fragile technology of optical character recognition too hard. It doesn't try to make OCR of faxes a hands-off process that can proliferate sizable files and fill up a great deal of hard disk space.

Like any OCR program, FAXability Plus/OCR can be a hero or it can be a goat, mostly because of circumstances beyond its control. When incoming faxes have crisp, straight text such as laser printer output, FAXability/OCR is a hero: It helps you transform the faxes into clean text files at a rate equivalent to twice the speed of a good typist, as fast as 150 words a minute.

But if the sending fax machine skews the image, the document is heavily formatted, the typeface is small, or worst of all, the fax has poor resolution, the labor savings of using FAXability Plus/OCR (as opposed to retyping the document) can drop into the negative numbers. The bottom line is that the software does very well with faxes of documents produced on PCs and typewriters but is next to useless when it comes to recovering text from sources like magazines and newspapers.

In either version, FAXability's speed is good and seems even better, mostly because the program does so much of its work in the background and hardly ever calls attention to itself by slowing down what's being done in the foreground. FAXability Plus/OCR requires a robust PC:

FIRST LOOKS PLUS

To download a demo of FAXability Plus, type GO ZNT:DEMOS from CompuServe. From Sept. 28 through Oct. 2, discuss FAXability Plus with David DeJean and Intel's Audrey Whitfield. Type GO ZNT:EXEC.

IF THIS IS THE BEST SOFTWARE FOR SIMPLIFYING INFORMATION, HOW COME THIS AD IS SO LONG?

Considering the amount of ink used to cover most revolutions, this ad is actually rather brief (and this *is* a revolutionary product, after all).

Anyway, here are two sound reasons why we made this ad longer than most of the ones you're used to reading:

1) If you're thinking of buying a Personal Information Manager (or upgrading), the more information you have, the more well-informed your purchase decision will be.

And 2) Commence™ simply does an amazing number of things.

LET'S BEGIN AT THE BEGINNING.

Commence was developed by Jensen-Jones, the folks who created IBM Current,™ so naturally it comes with all of the standard features you'd expect in a PIM. Including everything you need to organize and prioritize your tasks, meetings, business contacts, schedules and more.

But Commence goes much, much further, to the point of rendering other PIMs obsolete.

How? By redefining PIM customizability in a way that makes it astonishingly easy to tailor Commence to your specific needs and applications. All with the point-and-click ease of Microsoft® Windows.™

And, perhaps most important, it's the first PIM that features task automation. Using a revolutionary breakthrough called agent technology, Commence actually does work for you—*automatically*.

Now that we have whetted your appetite with the really intriguing stuff, let's go back to the basics for a minute.

USE COMMENCE RIGHT OUT OF THE BOX, OR CUSTOMIZE IT.

Commence can go to work for you right out of the box, with two ready-to-use databases and a variety of standard views. But, unlike most PIMs that let you make only minor adjustments, you can completely customize Commence to fit the unique needs of your business or industry.

Whether you're running a small start-up or an entire department of a multinational firm, you can add, create or rearrange fields, views, categories and connections so that Commence works the way you work.

If you need to view your customers by size, region or other criteria, no problem. Want to keep track of your truck fleet's mileage? The status of your inventory? Distribution of your equipment? With Commence, it's simple.

Here's just a partial list of some Commence views you can use right out of the box or modify to suit your needs:

- Address book
- Appointment calendar
- Billing report
- Conference rooms
- Expense report
- Free form notes
- Gantt view of tasks
- Letter log
- To-Dos
- Projects
- Plus, you can add any other view you want

LET AGENTS DO YOUR WORK FOR YOU.

And now, a few words about an advanced new technology called *agents*. Much more powerful than traditional macros, agents let you totally automate many of the tasks you used to do yourself. Here's how they work.

First, you select a *trigger* that will activate an agent. Then specify the *actions* you want to take place. For example, you can specify time triggers, such as at 5 PM every day, or at ten in the morning the first day of every month.

Or you can specify data triggers, such as when a sales order exceeds $5,000, or when inventory is below 25 units.

You can then specify actions that will alert you, display data that you need, execute another command, launch an application, etc.

The next time all the conditions specified in the trigger are met, the actions you asked for will occur automatically.

Now, if you've read this far and haven't nodded off yet, do keep going, because we're about to get to the really good stuff.

THIS IS THE BEST PART OF THE AD, EXCEPT FOR THE SPECIAL OFFER.

By now you're probably thinking, "Okay, I sort of understood that last section, but what can these agents and triggers do for *me*?" Well, here are some examples of how you can use agents to help you:

- *Automatically* print a report of all your daily appointments and their details every morning at 9:00.
- Print out your To-Dos and calendar for the next week the evening before you're scheduled to travel.
- Mark all of today's incomplete To-Dos as overdue and assign them to tomorrow's project list.
- *Automatically* fax a flower delivery authorization to your florist for any customer who places an order over $10,000.
- Display a view each morning at 9:30 of every customer who hasn't placed an order in two weeks.
- Send yourself a reminder one week in advance of any scheduled presentations so that you'll have adequate time to prepare.
- *Automatically* switch any task that contains the words "urgent" or "immediately" to your high-priority message or To-Do list.
- Run a disk diagnostic program Thursday at midnight and save the results.

As you can see, the possibilities for saving time and simplifying your life are (like this ad) almost endless.

Call today for your Free Working Model.

PUT COMMENCE TO WORK ON YOUR MOST DEMANDING INFORMATION APPLICATIONS. THEN RELAX.

All that customizability that Commence brings to standard PIM functions also lets you handle much bigger applications with equal ease. Here are just a few of them:

- Sales contact management
- Meeting and appointment scheduling
- Assigning and tracking daily tasks
- Company time and resource allocation
- Project management
- Expense tracking, reporting and auditing
- Customer database management
- Telemarketing sales management
- Inventory tracking and control

A LOT MORE FEATURES, A LITTLE MORE HYPE.

Before sending you off into the jungle that the PIM marketplace has become, we'd like to elaborate just a little bit more on some of our standard features.

Flexible calendar and scheduling lets you view meetings, To-Dos and travel in monthly, weekly or daily views. You can automatically schedule events on recurring dates. It even prints in familiar day planner format.

True database power lets you record up to 8,000 items per category with up to 100 categories per database, and keep multiple databases. Each item can have up to 50 fields and connections. You can even include graphics images in category items.

Powerful connections facility lets you connect people to projects, notes to tasks, appointments to people, and more. Type information once, and it automatically appears in all relevant views. Commence has built-in connections right out of the box. And it's easy to set up your own.

DDE links to other Windows applications give you dynamic access to information in Commence from word processors and spreadsheets.

Letter templates let you write standard form letters that you can send to people on your customer, contact and phone lists — one at a time, or several at once.

Spell checker ensures proper spelling in your text entries.

Powerful import/export facility lets you easily exchange data with your other applications, as well as with other Commence databases.

Auto phone dialer automatically dials all appropriate numbers including area and international codes.

Built-in letter writer lets you take advantage of Commence's integration with other Windows word processors, like Microsoft Word for Windows™ and Lotus® Ami Pro.™

Extended sorting and filtering capability lets you set up to four criteria, so you always see exactly the information you want.

Built-in Gantt charting gives you a graphical snapshot of task status.

GET A FREE WORKING MODEL OF COMMENCE.

Now that we've gone to such great lengths to convince you that Commence can do everything except lower your taxes, you're probably ready to see this PIM in action. And you can, too. We'll send you a complete Working Model of Commence, along with an informative guide, all for the amazing low price of nothing. That's right, it's absolutely free.

To order, call Jensen-Jones at 1-800-289-1548 ext.1123.

Yes, this is a long ad. But think of all the time you can save for having read it.

COMMENCE™
THE AUTOMATED INFORMATION MANAGER FOR WINDOWS

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CIRCLE 178 ON READER SERVICE CARD

While the program will run on a 286 with 4MB of RAM, a 386 is the practical minimum. On a 486, your PC can receive a fax, recognize text in a document, and work in a word processor, all without running at the slow crawl that has been the bane of performing OCR in Windows.

FAXability Plus/OCR's list of features sticks to the basics and leaves the fancy stuff to more muscular OCR packages. It doesn't provide fancy tools for decomposing the fax image and performing recognition on the parts, or for identifying and saving graphics into separate files. There's no way to schedule deferred recognition of a batch of faxes or to train the recognition engine of the OCR on special characters in the text.

Still, this program does some very intelligent things that are specifically geared to working with faxes. It will automatically sense pages that have been transmitted upside down in a fax file, flip them over, and read them correctly. Its repertoire of formats to save to includes four variants of .PCX and TIFF and no fewer than 58 formats for documents, spreadsheets, and database files. There is also a format called Decolumnized ASCII that really shows off the strength of the OCR engine; it takes apart multicolumn pages and reassembles them as one long single column.

Unfortunately, the intelligence behind such features is dimmed by a dull installation routine and extremely weak documentation. If you use Stacker, for example, FAXability's install can't write its necessary path information into your AUTOEXEC.BAT. This wouldn't be so terrible in itself, but the information is not on-screen, and is nowhere in the documentation. It's fortunate that Intel PCED's tech support is very accessible and helpful.

NEW MODEMS

The same intelligence that shines in most aspects of the FAXability Plus software is evident in PCED's new line of fax modem/data modem hardware.

At the top of the line is the $499 SatisFAXtion Modem/400, a three-quarter-size card for one-stop telecommunications shopping. It combines a 9,600-bps fax modem with a 9,600-bps data modem, a hand-scanner port compatible with the TWAIN specification, and a buffered UART architecture with 512K of memory to prevent data overruns at high speeds.

This modem supports the Telecommunications Industry Association (TIA) 602 command set (that's the new way of saying "Hayes-compatible"). And it is compatible enough to work well with Hayes drivers from many applications. It's a V.42/V.42bis device that also uses MNP levels 1 to 5 for error correction and data correction. An external version of the 400 is available as the $549 SatisFAXtion Modem/400e.

The 400 is intended to be primarily a fax modem, but its operating software helps the fax and data modem functions to coexist peacefully: An auto-interrupt feature, for example, lets the data modem take over the phone line from fax transmissions without trashing the transmission schedule.

The other new members of the SatisFAXtion family are the SatisFAXtion Modem/200 (a $369 combination of 9,600-bps fax modem and 2,400-bps data modem that replaces the SatisFAXtion Board) and the $129 SatisFAXtion Modem/100 (which sends faxes at 9,600 bps, receives at 4,800 bps, and handles data at 2,400 bps).□

■ Windows Utilities

hDC's Power Toolboxes Adds Custom-Made Toolbars to Windows Applications

BY GREG KEIZER

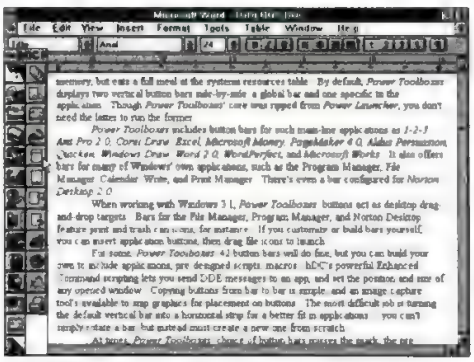
Instant gratification in Windows comes at the push of a button. Start the spell-checker? Push a button. Recalculate a spreadsheet? Push a button. Draw a chart? Push a button.

Toolbars—those iconic rows of buttons for common commands—are all the rage. hDC Computer Corp.'s Power Toolboxes, a new $39.95 utility that's a subset of the company's Power Launcher, adds preconfigured toolbars to 42 Windows programs. Only its meager documentation stands in the way of its claim of toolbar supremacy.

Power Toolboxes consumes very little memory but eats up plenty of system resources. By default, Power Toolboxes displays two vertical toolbars: a global bar and one specific to the application.

It has toolbars for such mainstream applications as Aldus Persuasion, Ami Pro, CorelDRAW, Lotus 1-2-3 for Windows, Microsoft Excel, Microsoft Money, Microsoft Word for Windows 2.0, Microsoft Works, PageMaker 4.0, Quicken, Windows Draw, and WordPerfect. The program even has a toolbar configured for The Norton Desktop for Windows, Version 2.0.

In Windows 3.1, Power Toolboxes' buttons act as desktop drag-and-drop targets. Toolbars for File Manager, Program Manager, and The Norton Desktop feature print and trash can icons, for instance. If you customize or build toolbars yourself, you can insert application buttons, then drag file icons to launch the app.



BAR TOOL: *On the left is Power Toolboxes' toolbar for Microsoft Word for Windows.*

For some, Power Toolboxes' 42 standard toolbars will do fine, but you can build your own to include applications, predesigned scripts, and macros. hDC's powerful Enhanced Command scripting lets you send DDE (Dynamic Data Exchange) messages to an app. There's also an image-capture tool to snip graphics for placement on buttons. The most difficult job is turning a default vertical toolbar into a horizontal strip for a better fit in applications. You can't simply rotate a toolbar, but instead must create a new one from scratch.

At times, Power Toolboxes' choice of toolbars misses the mark; the predesigned toolbars for Ami Pro and Word for Windows offer little that you can't add to their own toolbars.

Power Toolboxes' biggest problem is its scanty documentation. hDC should have included the appropriate sections of the Power Launcher documentation.

Once past that problem, you'll find Power Toolboxes a worthwhile addition to your Windows portfolio. Its instant-access approach, though not original, takes the toolbar to every corner of Windows.

• List Price: *Power Toolboxes, Version 1.0, $39.95.* Requires: *2MB RAM, Microsoft Windows 3.0 or later. hDC Computer Corp., 6742 185th Ave. NE, Redmond, WA 98052; 800-365-8553, 206-885-5550; fax, 206-881-9770.*

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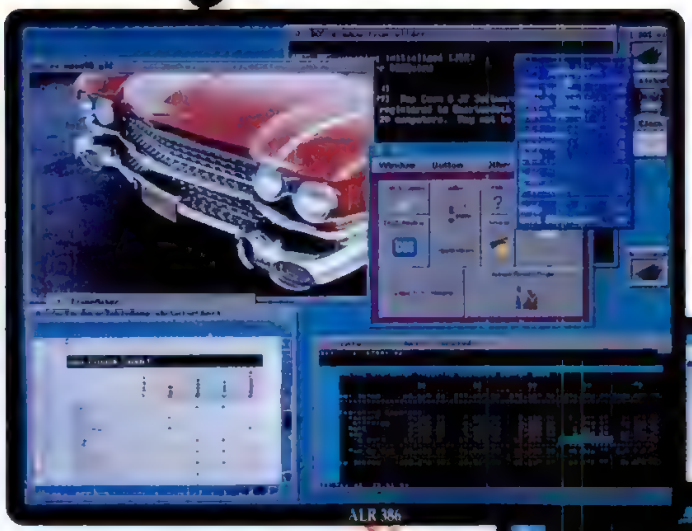

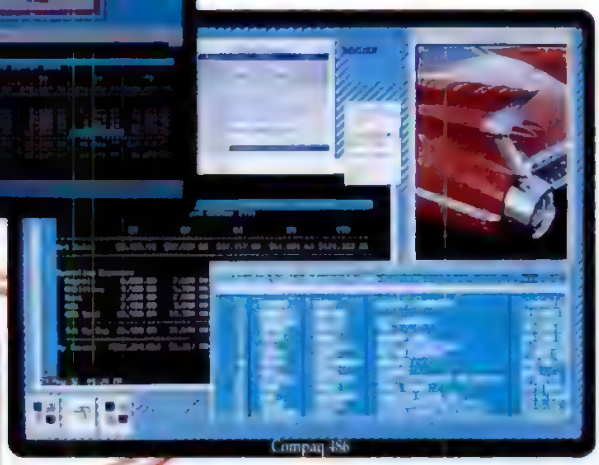

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CIRCLE 338 ON READER SERVICE CARD

Portables

Dell Breaks the Full-Featured 4-Pound Barrier with Compact 320SLi Subnotebook

BY EMERSON ANDREW TORGAN

Walk 20 blocks or run from one end of an airport to another with a portable PC in your briefcase and you'll think of it as a battery-powered millstone. Dell Computer Corp. recognizes the problem and has done something wonderful about it.

The Dell System 320SLi is a 20-MHz 386SL-based notebook PC weighing a mere 3.6 pounds with a battery. In order to achieve this remarkable weight, Dell has employed a new screen technology. The screen, developed by Dell and Sharp Electronics Corp., is a 9.5-inch reflective TSTN (triple-supertwist nematic) monochrome LCD that uses 75 percent less power than traditional edge-lit LCDs. It also provides a 12-to-1 contrast ratio, a 640-by-480 resolution, and up to 64 shades of gray.

3.6 POUNDS: *The Dell System 320SLi has a 9.5-inch reflective screen.*

The lack of backlighting makes the screen somewhat difficult to read in poor light, but if you toggle through three full-screen display font settings and between normal and reverse video modes, the new LCD proves more than adequate under normal lighting conditions.

POWER MANAGEMENT

The lower power consumption of the new LCD, which is directly mounted into the housing to reduce the system size and weight, means that this notebook can use smaller and lighter nickel hydride batteries.

The 320SLi has a number of power-management features, including a Smart CPU mode that slows the clock speed to 2.5 MHz after 12 seconds of peripheral I/O inactivity. You can also set the clock speed to 20, 10, 5, or 2.5 MHz via key combinations. The Continuous Display mode combines the Smart CPU and LCD standby modes for continuous screen display without blackouts.

The 320SLi lasted 2 hours 29 minutes on our Battery Rundown test with all of its power-saving features disabled. More traditional power-management features include control settings for powering down the hard disk and a suspend mode (invoked by pressing a button or closing the case) that draws only enough battery power to maintain any data stored in system memory. The screen's power consumption is minimal, and enabling the unit's power-saving options should effectively double the battery life.

You can look around the edges of the 1.25-by 11-by 7.75-inch case for a floppy disk drive, but you won't find one. Dell chose to equip the system with an external unit to reduce weight. The drive, which is a technical achievement in its own right, weighs 12 ounces and is not much larger than the floppy disk you put in it. The drive connects to the system at the combination parallel/external drive port.

Whether or not a portable PC should have an internal floppy disk drive is the source of some debate. Some users demand one, while others are happy with the trade-off between a light weight and some file transferring when their travels are over. Should you choose to bring the external drive along, chances are you won't notice any significant increase in weight.

GREAT KEYBOARD

The 85-key keyboard provides 12 dedicated function keys and separate Home, End, PgUp, and PgDn keys, as well as arrow keys in the preferred inverted-T layout. Intelligently arranged, the keyboard has a solid feel you might not expect from such a thin housing. Although not quite full-size, the function keys are logically placed and have the same solid return. An integrated keyboard mouse (comprising the Fn and arrow keys) is functional, but Microsoft Windows users will opt for keystrokes or carry a mouse or trackball.

KEYBOARD: *The 320SLi has separate Home, End, PgUp, and PgDn keys.*

60MB HARD DISK

The $1,969 System 320SLi that we tested was configured with 2MB of RAM (expandable to 10MB), an external floppy disk drive, a PCMCIA 2.0 slot (capable of accepting Dell's $249 2,400-bps Lightpack 2400+ modem), and a 60MB hard disk with DOS 5.0 and Windows 3.1 preinstalled.

Dell's first attempt at a subnotebook (Dell likes to call it a "superportable") sacrifices little in the areas of power and usability and deserves much praise. The result is a durable unit that combines innovative technology, intelligent engineering, and a keen sense of what is most important to the portable PC user. □

FACT FILE

Dell System 320SLi
Dell Computer Corp., 9505 Arboretum Blvd., Austin, TX 78759; 800-289-3355, 512-338-4400; fax, 512-343-3653.

List Price: With 2MB RAM, 60MB hard disk, $1,969; with 80MB hard disk, $2,169; with 120MB hard disk, $2,369
In Short: There is no excuse for leaving the Dell System 320SLi behind. Weighing only 3.6 pounds with battery, it is at home in any briefcase. If you choose to take along the lightweight external floppy disk drive and AC adapter/battery charger, the total weight will be 5.3 pounds

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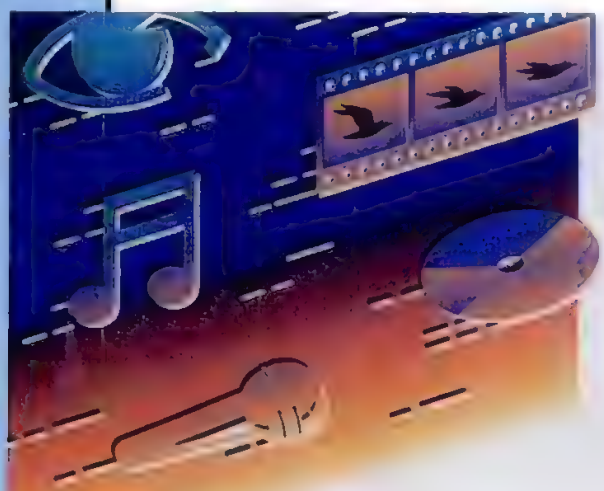

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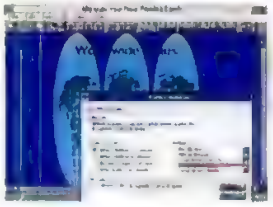

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■ Document Processing

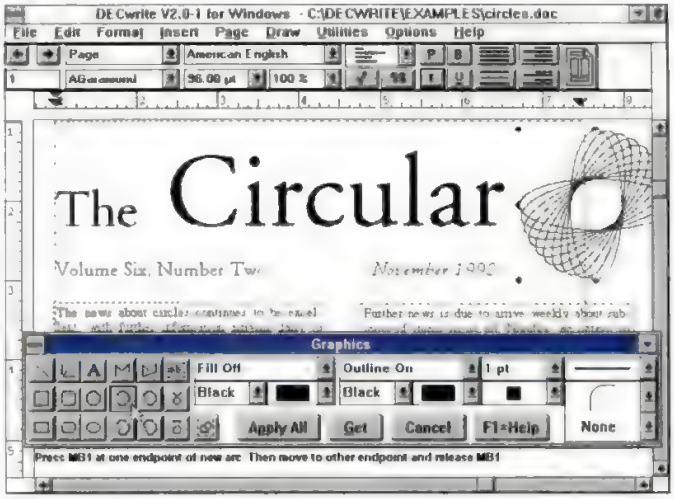
DECwrite: Page Layout for Multiple Platforms

BY EDWARD MENDELSON

Digital Equipment Corp.'s DECwrite 2.0 for Windows has features like those of high-end word processing and desktop publishing programs, but it adds the ability to share files over a network by using versions of the same program written for Digital's VMS and ULTRIX systems and Sun workstations. Digital designed this $695 package ($2,995 for ten copies) to look and feel identical on all platforms.

The result is a program that's powerful when formatting complex documents and easy to use if you know Digital's keyboard by heart. But it will leave most Microsoft Windows users frustrated when they find that VMS compatibility means that familiar Windows keystrokes produce different effects than they had anticipated.

DECwrite uses stylesheets for text formatting and frames for page layouts and illustrations. You work on a WYSIWYG screen, complete with page margins. An icon-based function bar lets you select styles and layouts. You can't remove the bar from the screen, although there are keyboard shortcuts for all its functions.



PAGE LAYOUT: *DECwrite's screen includes a busy function bar, rulers, and a message box at the foot.*

DECwrite includes a table editor and a drawing module that are generally less powerful than Ami Pro's. The program offers a spell-checker, thesaurus, and grammar checker, but it lacks the charting and equation modules found in most rival packages. Multilevel lists are possible, but you don't get collapsible outlining. You can create separate text flows, as in a newspaper—a feature usually found only in DTP packages.

Text imports are accepted only in ASCII or Digital's WP-PLUS formats; graphics, charts, and equations are accepted only in EPS and Digital Document Interchange formats. You can record keystroke macros, but you don't see a list of them, and the program will not warn you if they overwrite built-in macros.

STRENGTH IN STYLES

DECwrite's unique strength is its styles. The style for a header can automatically select a layout for the page, and that page layout can specify the page layout that follows it. This means that you can automatically create a newsletter layout in which the main title appears on a page with two columns, while the remaining pages have three columns.

As with FrameMaker, you can create and modify page layouts on nonprinting template pages that are automatically stored with your text. Page formatting can be applied directly to text pages, but you may need to go to a template page for the awkward task of undoing that applied formatting.

For example, if you use the main menu to split a text page into two columns, the only way to get it back to one column is to go the corresponding template page, split it into two columns, return to the text page, go back to the template page to restore it to one column, and then return again to the text page.

DECwrite lets you generate multilevel tables of contents automatically from headings created in specific styles. The program supports cross-references and indexes, but index entries can't span multiple pages.

KEYBOARD FRUSTRATION

DECwrite's weakness is its keyboard interface, which violates almost every Windows norm. The Esc key won't get you out of some menus; you have to use Ctrl-C instead. The Home key opens the search menu; the End key toggles a text selection mode. (You press Ctrl-H and Ctrl-E to reach the start and end of a line, respectively.) Amazingly, you press NumLock-PgDn instead of Ctrl-End to reach the end of your text, and you will be infuriated by a menu that tells you to press "PF1/Down" instead of NumLock-PgDn.

The program supports variables, but you actually have to type in the current date to use the built-in "date" variable. Parts of the screen blank out when you close a menu or change a zoom level, and you have to press a refresh key in order to get this area back. When you press a cursor key, a baffling message that the cursor isn't located anywhere occasionally appears. The program sometimes gets so confused that it enters your text in a message bar at the foot of the screen instead of in your file.

Although DECwrite lets you share documents on a network and combine multiple files into a book, it offers no network security features. If two users open a file, the one who saves the file last has the changes saved to disk.

DECwrite is worth considering if you normally work on a Digital platform and need a compatible word processor for occasional use in Windows. But Version 2.1, due in January, will give you the option of using a standard Windows keyboard and will fix most of the program's minor flaws. Until then, you'll find fuller sets of features in Ami Pro or FrameMaker, with far less frustration. □

▶ FACT FILE

DECwrite 2.0 for Windows

Digital Equipment Corp., 146 Main St., Maynard, MA 01754; 800-344-4825, 603-884-6660; fax, 800-234-2298

List Price: $695

Requires: 4MB RAM (6MB for networks), Microsoft Windows 3.0 or later

In Short: DECwrite 2.0 for Windows has some unique page layout strengths, but its DEC/Windows split personality may leave Windows users frustrated. Version 2.1 will be more Windows-compliant.

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■ **Project Management**

ProjectGuide Turns Building A Project Into an Interview

BY HENRY FERSKO-WEISS

The intimidating jargon and special techniques of project management have kept it out of the hands of many potential users, but now Marin Research has taken a big step away from those barriers with its $895 ProjectGuide Professional Edition for Windows.

The professional version of the package lets corporate planners and third-party developers build project templates called guides. Through dialog boxes, these guides ask users questions about a project and then build a task list, a critical path network, and a resource plan for a particular project.

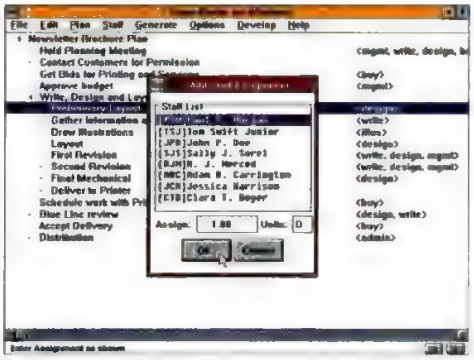
After a project is created, the program generates a project model in the format of any one of several popular project management packages, including CA-SuperProject for Windows, InstaPlan, Microsoft Project 3.0 for Windows, ABT's Project Workbench, Time Line 5.0, and Time Line for Windows.

DEVELOPER'S TOOL

Although Marin Research is exploring the possibility of offering an end user product with a host of project templates, ProjectGuide is currently only a developer's tool. The program's own proprietary language lets the developer produce a generic project model and surround it with dialog boxes.

The program comes with one sample guide, for a project that involves producing a marketing brochure. In its dialog boxes there are questions about the nature of the graphic components of the brochure, how and where they're to be made, and how long different parts of the process will take.

To start building such a guide, you import an existing project from the project management package you use. Without any effort, you have a task list, the relationships between tasks, and a resource pool. At this point, all you have to do is design the dialog boxes.



WHO DOES IT? *ProjectGuide lets you build your project in outline style, then assign resources.*

There are about 40 language commands for building dialog boxes. You can include radio buttons, check boxes, text, buttons, scroll bars, and bitmapped images. With these commands and single-line statements you can accomplish nearly anything.

ProjectGuide's programming language isn't too difficult, but if you don't have programming experience, it will take you a fair amount of time to learn. Even simple sets of dialog boxes can take 100 or more lines of code and hours to develop.

ProjectGuide comes with a few templates to help developers get started: In addition to the marketing brochure guide, there's one for basic application software and one for going to a trade show. But being able to import any project makes starting a new template quite easy. As a peripheral benefit, a project imported from one project management program can be exported later to any of the many other packages ProjectGuide supports, making it an instantaneous conversion utility.

When the developer's work is finished, the templates can be distributed to end users with runtime versions of the program, at a cost of $295 per package ($199 if you order five or more). The end user picks a guide to run, then he or she is led through the creation of an entire project.

The first dialog boxes may request information on the nature of the project's output or goal. For example, the first dialog box in the marketing brochure guide elicits information on the cover and inside color for the brochure, the number of pages, and whether the contents include photos, new drawings, and or quotes/endorsements. If you check the box for quotes/endorsements, up comes another dialog box that tells you, "These generally require written permission," followed by check boxes for the sources of the quotes.

As you respond to the questions and prompts in the dialog boxes, an outline of project tasks is generated. As each group of tasks in the project is planned, you can select from a list of proposed tasks.

If there are potential schedule problems based on your responses, error messages pop up explaining the problems. Unfortunately, all you can do is accept the situation and move on. You have to check out the problems later on your own.

RESOURCE ALLOCATION

ProjectGuide offers excellent resource-assignment facilities. The program will automatically staff a project or let you do it manually. Resources can be assigned as materials or people. When staffing is done manually, you pick people based on proficiency scores. These scores are collected in an experience database. As experience information is added, the score for a particular person will change. The proficiency factors for a person can be used to alter the time required for each assignment, resulting in a resource-driven schedule.

ProjectGuide's one weakness is its inability to take resource availability into account. Once the schedule is created, however, you can add this element in the project management package you use.

ProjectGuide is a fascinating program. Within minutes of sitting down in front of the screen you can complete a project, generate a version of it for your project management package, and produce Gantt and PERT charts to bring into a meeting. For the corporate planner, it's a way to ensure consistency of project design throughout the company. □

FACT FILE

ProjectGuide Professional Edition for Windows, Version 1.0

Marin Research, 38 Miller Ave., #10, Mill Valley, CA 94941; 415-389-5444; fax, 415-389-5448

List Price: $895, runtime version, $295 (for five or more copies, $199 per copy)
Requires: 2MB RAM, Microsoft Windows 3.0 or later
In Short: ProjectGuide Professional Edition for Windows acts as a front end to several leading project management packages, automatically generating projects from information entered into screens you design through a proprietary language

421 DN READER SERVICE CARD

Video

SpeedStar 24X Offers 16.7 Million Colors for Windows And a $249 Price Tag

BY BEN MYERS

Diamond Computer Systems' SpeedStar 24X graphics card provides 16.7 million colors in 640-by-480 mode and a choice of monitor resolutions up to 1,280-by-1,024 for a modest $249. The diminutive card (3.5 by 6.25 inches) is built around the Western Digital 90C31 graphics accelerator chip and has 1MB of 70-nanosecond DRAM video memory.

The board installs easily, with three jumpers to deal with system and BIOS incompatibilities and four DIP switches to set up default monitor timings for 800-by-600 and 1,024-by-768 resolutions. The SpeedStar 24X graphics card is compatible with a wide range of multisynchronous and fixed frequency monitors.

SPECIAL DRIVERS

The SpeedStar software installation program copies its Windows drivers to your Windows directory and installs a Diamond icon, which activates a program to change resolution and color depth. Diamond provides its own Windows drivers instead of the standard drivers available from Western Digital Corp. By using the specially tuned drivers, the SpeedStar 24X card turned in an average Graphics Winmark score of 7.8 on PC Magazine Labs' WINBENCH graphics performance tests, a respectable showing for a video accelerator in this price class.

An included program lets you select the model of monitor connected to the adapter and to adjust the size of the image onscreen to suit your needs. You run it whenever you want to use the custom monitor settings that you have chosen (running the program from AUTOEXEC .BAT makes this an automatic task).

Also included with the SpeedStar 24X are Panacea's AutoCAD Display List Drivers; the HALO Desktop Imager, a tool for editing and manipulating photographic images; and high-resolution DOS drivers for Lotus 1-2-3, Microsoft Word, and WordPerfect.

The megabyte of on-board video memory necessarily limits 24-bit resolution to 640-by-480, but the SpeedStar 24X offers a good variety of other resolutions and colors.

If you don't need higher resolutions for 24-bit color work, you may find the SpeedStar 24X's combination of solid performance, a wide range of resolutions, software extras, and a reasonable price very compelling.

• List Price: *SpeedStar 24X, $249. Diamond Computer Systems Inc., 532 Mercury Dr., Sunnyvale, CA 94086; 408-736-2000; fax, 408-730-5750.*

Circle 424 on reader service card

Communications

WorldPort Fax/Data Modem Is Specifically Designed for Palmtop Computing

BY M. DAVID STONE

To call the $249 WorldPort Palmtop Fax/Data Modem unusual is an understatement. This may be the only modem ever designed with an RS-232 port but aimed at a niche market: palmtop computers.

Palmtop computers have all sorts of limitations, not the least of which is a shortage of storage capacity. But given the importance of faxing and the large capacity needed for fax programs, U.S. Robotics is hoping that you'd like to have a modem for your palmtop that will send faxes without fax software.

TRAVELLING COMPANION

Physically, the WorldPort modem is an appropriate palmtop companion, weighing in at just 6.5 ounces, complete with a 9-volt battery and measuring 1 by 2.3 by 3.8 inches (HWD). The modem offers a DB-25 connector and comes with a DB-25–to–DB-9 converter, a 6.5-ounce AC adapter, and a copy of Crosstalk Communicator, a full-function communications program.

As a data modem, the WorldPort Palmtop unit is strictly garden-variety and somewhat behind the times as well. The WordPort is limited to a maximum of 2,400 bits per second using the V.22bis protocol; it also offers 1,200- and 300-bps capability with both U.S. (Bell 212 and 103) and worldwide (V.22 and V.21) protocols.

Missing from the modem is any sort of built-in error correction or data compression. You'll find a speaker and status lights to indicate a low battery, high-speed connection, carrier detect, and a call in progress.

THAT'S PORTABLE: *The WordPort Palmtop.*

FAX TRANSMISSION

Most important is the modem's fax translation feature—the ability to translate a file from ASCII text to fax format and send it at up to 9,600 bps.

To send a fax from a comm program, you enter an AT dialing command that includes the modem's fax commands. The modem responds with the message "Load Text File." You can then either type a message at the keyboard or upload an ASCII file. The modem will dial the number, establish communications, and send the text as a fax.

Alternatively, you can send a fax by way of a batch file that initializes the comm port, copies a file containing the dial command to the port, and then copies the ASCII file to the port. With this approach, you don't even need a communications program.

All of this works as advertised, but the process demands a fair amount of technical sophistication, even though the step-by-step instructions in the manual are explicit and easy to decipher.

If you're comfortable with the primitive fax accommodations and you like the idea of keeping bulky fax software off your palmtop, then you'll like the WorldPort modem, even if it does feel like an interim solution. This tiny communicator will do until palmtop computers improve, or until something better comes along.

• List Price: *WorldPort Palmtop Fax/Data Modem, $249.* Requires: *Serial port; for Crosstalk Communicator: 512K RAM, DOS 2.0 or later. U.S. Robotics Inc., 8100 N. McCormick Blvd., Skokie, IL 60076; 800-342-5877, 708-982-5001; fax, 708-982-5235.*

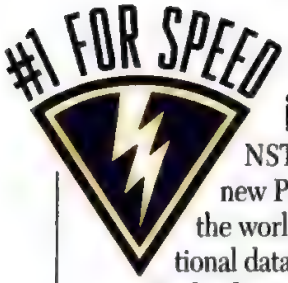
Circle 423 on reader service card

DEMAND PERFORMANCE

Introducing Paradox 4.0 for DOS

The most advanced database is now the fastest

DEMAND



Paradox is fastest

NSTL results prove new Paradox® 4.0 is the world's fastest relational database! Thanks to Borland's new WarpSpeed™ performance, Paradox 4.0 sets the standard in performance for both network and standalone use. For you, this means faster answers to queries, faster memory access and faster multiuser applications.

In fact, Paradox 4.0 gives you unparalleled performance throughout all aspects of database management and application development. As NSTL put it, "Paradox is clearly the best all-around product evaluated." It beats FoxPro hands down.

Software Digest's *NSTL report rates Paradox highest of all databases tested in Overall Power and Performance.*

New Windows-like interface

Our new Windows-like interface makes using Paradox 4.0 more intuitive than any other database. Context-sensitive SpeedBar™ controls give you instant access to your frequently used commands and features. Movable, resizable windows, pull-down menus and mouse support make creating and editing your database simple. And new dialog boxes give you the choices you need in one place, saving time and effort.

The fastest way to get an answer

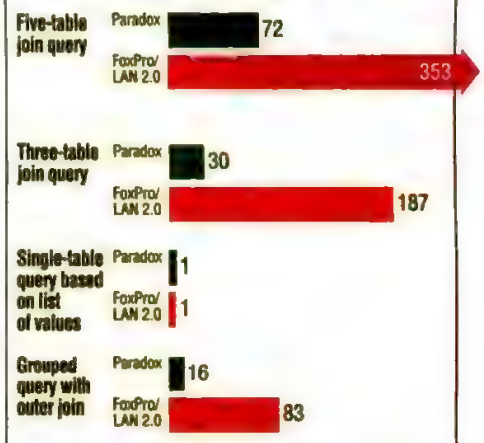
Paradox pioneered Query By Example (QBE), the easiest way to get answers from your database. Now, a built-in query optimizer enhances QBE, automatically finding the fastest path to the answers you're seeking. Plus, multi-table forms and reports make everything from data entry to presentations a snap—all without programming.

WarpSpeed

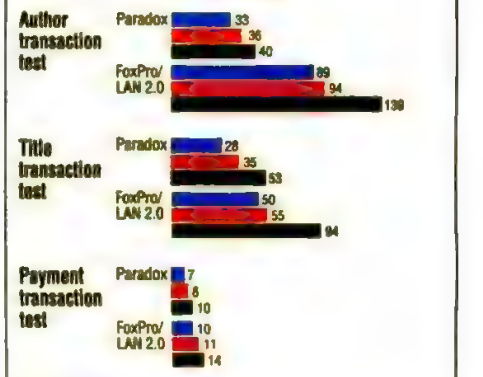
WarpSpeed stands for Wildly Accelerated Relational Performance. It reflects Borland's commitment to performance, and is also an integral part of our dBASE® and InterBase™ development programs.

NSTL tests confirm Paradox 4.0: Quicker than a Fox

Single-user performance tests
(in seconds)



Multiuser performance tests
(in seconds)



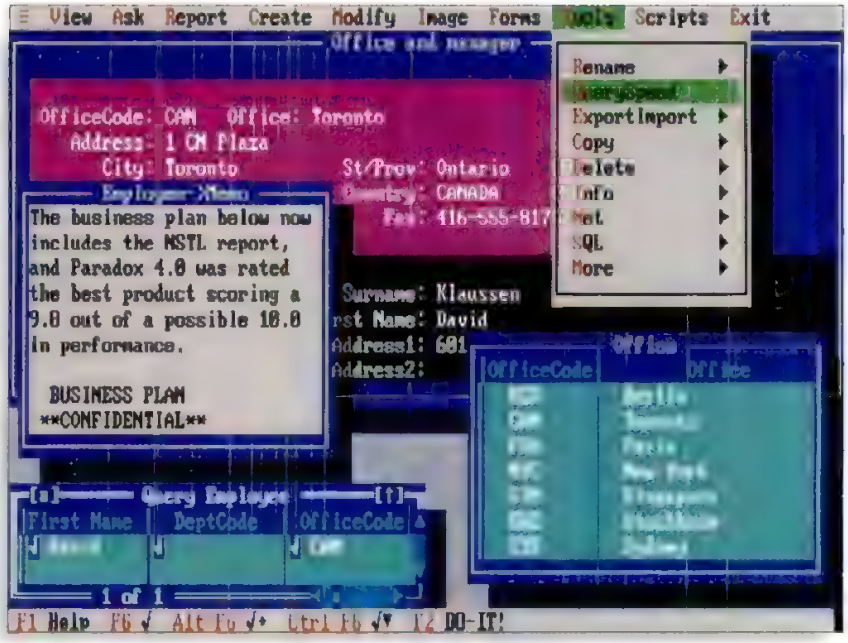
Multiuser Legend:
1 station ■ **3 stations** ■ **8 stations** ■

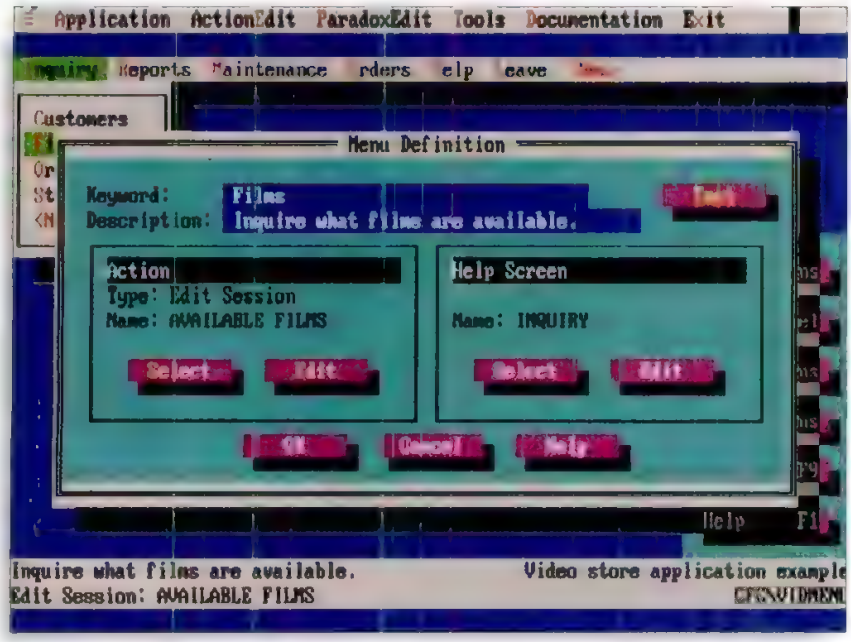
To test the speed of transaction performance, NSTL designed a database for book order entry. Each record contained an author, a title, an ISBN number, a price and inventory information. The database contained 25,000 books and 5,000 authors.

PARADOX

New memo fields

Paradox 4.0 gives you the power to manipulate data you couldn't manage with ordinary databases. With new variable length memo fields, you have the ability to effortlessly manage large amounts of text information throughout your applications. And you can store anything you want in the new binary field—word processor documents, sound, bitmapped graphics, multimedia data—and then manipulate it under program control. Each can hold up to 256Mb of data per field—up to 4 gigabytes per table! There's no easier way to manage large applications.





◀ *With the new Applications Workshop, you can build complete applications that include pull-down menus, mouse support, transparent multiuser edit sessions and more. Best of all, it's simple!*

Efficient memory management

Paradox 4.0 gives you the best way to manage memory. VROOMM™ with Turbo Drive™ provides more available memory and more efficient memory utilization. So Paradox 4.0 runs on any 286 PC or above. In addition, Paradox 4.0 can run as a DOS application under the Microsoft® Windows operating environment, thanks to complete DPMI support.

DEMAND

The most award-winning database

Since its introduction, Paradox has won more awards for technical excellence and customer satisfaction than *any* other database. Awards from every major computer magazine and periodical from around the world. In addition, in the J.D. Power and Associates® survey,* Borland ranked as the #1 (tied) Application Software Publisher in Customer Satisfaction Among Business Users. All of which has made Paradox the favorite of users and developers alike.

Software Digest
PARADOX® SQL LINK
★★★
Rated # 1
Vol. 8, Number 2
February 1991

PC MAGAZINE
EDITORS' CHOICE
May 26, 1991
Paradox, Version 3.5

PC WORLD
BEST BUY
May 1991
Paradox 3.5

1992 BYTE READERS' CHOICE AWARD
March 1992
Paradox 3.5

Software Digest
PARADOX® 4.0
★★★
Rated # 1
Vol. 9, Number 2
May 1992

#1 Tied in Customer Satisfaction Among Business Users*

J.D. POWER AND ASSOCIATES

1. **Borland**
1. WordPerfect
3. Lotus
4. Microsoft
5. Claris
6. Aldus

Faster network performance

Paradox 4.0 is the fastest multiuser network PC database ever. And it's network-ready right out of the box. Multiple users can read, write and modify data simultaneously. You get all this, plus new automatic group lock security that allows multiple users to share data flexibly, providing dramatically increased performance. Just another reason Paradox 4.0 is the best investment for your business.

Transparent access to SQL data

With Paradox SQL Link (sold separately), you can seamlessly access remote SQL data. You can then work with this data using standard Paradox features such as Query By Example. Paradox does all the translation for you.

Paradox SQL Link completely shields you from the intricacies of PC and database server communications. When you specify an SQL table operation, Paradox SQL Link automatically selects the correct communications protocol, opens up

Paradox Developer's Corner

Powerful, procedural language

The Paradox Application Language (PAL™) lets you create sophisticated Paradox applications quickly. PAL procedures allow for private and global variables, array passing and variable scoping. Paradox 4.0 includes more than 90 new commands and functions.

Powerful UI controls

Easily construct your applications with a robust look and feel using the built-in UI controls: non-modal pull-down menus, dialog boxes (with push buttons, check boxes, radio buttons, pick lists, type-in lines and more), pop-up menus, mouse support and multiple overlapping windows.

Event-driven extensions

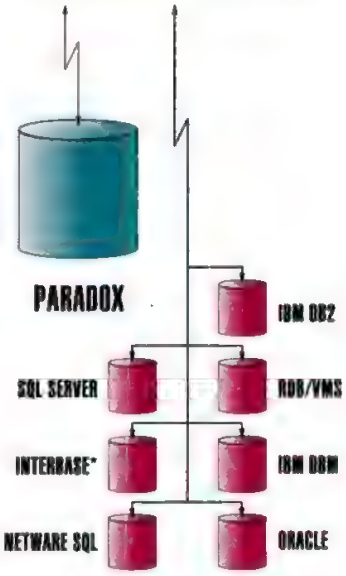
GetEvent() passes keyboard, mouse and/or system events into your procedures for dispatching. Use dynamic arrays to pass dynamically created data structures to procedures. This greatly increases the modularity and reusability of your code.

Leverage Paradox behavior

Build on Paradox's multiuser support for automatic locking, multi-table forms and referential integrity. Define special error-handling procedures to trap and process error conditions, giving you complete flexibility over users' interaction with your custom application.

*1991 J.D. Power and Associates 1991 Computer End User Satisfaction Study for Software Publisher: Phase IV: Business End User Summary. Responses from Business End Users at 4,396 business sites. Copyright © 1992 Borland International, Inc. All rights reserved. All Borland product names are trademarks of Borland International, Inc. Microsoft is a registered trademark of Microsoft Corporation. *Software Digest* is a registered trademark of NSTL, Inc. *Software Digest* Rating Report, Multiuser Database Programs, May 1992, Vol. 9, No. 2. BI 1461

BORLAND



*Paradox SQL Link supports more industry-standard database servers than any other PC database available. (*And the InterBase SQL connection will be available soon.)*

a communication link, relays statements to the database server and presents the results of your query.

By using Paradox SQL Link, you can now enjoy the benefits of SQL databases without the difficulty of mastering the SQL programming language. In addition, Paradox SQL Link operations follow database server security restrictions.

Borland—the database leader

Borland is the acknowledged leader in PC relational databases. More users and developers trust their data to Borland products than any other company. And an integral part of that trust is Paradox.

Paradox 4.0's power to create and manage sophisticated applications, maintain data integrity, handle large quantities of data, perform complex database operations and connect to corporate data is critical to the success of a database management system today. No other PC database meets this challenge like Paradox 4.0—the most advanced database. Best of all, with Paradox 4.0's 60-day, money-back guarantee, you can order risk-free today. So demand the best. Demand Paradox!

To upgrade or order, see your dealer or call 1-800-331-0877, ext. 5877 today!

Canadian customers call 1-800-461-3327.

BORLAND

Software Craftsmanship

CIRCLE 287 ON READER SERVICE CARD

■ PIMs

IBM Current Comes Back to Life as $395 Commence

BY JONATHAN MATZKIN

Whatever happened to IBM Current, one of the first personal information managers (PIMs) for Windows? With the dissolution of IBM's desktop software division, Current's original developer, Jensen-Jones, has gotten the program back from Big Blue, has revamped it, and is marketing it as Commence. This versatile $395 PIM comes with a set of tools that can organize ideas and manage time right out of the box, while ambitious users can customize the package to shape it to unique information management needs.

Commence considers each piece of data entered (such as an appointment or a task) to be an *item*, and items are organized into *categories*. Preconfigured categories cover all of the usual PIM bases; the Person category stores information on people, the To-Do category tracks tasks, and the Note category organizes free-form information. Commence allows you to edit existing categories or create your own with relative ease.

FOUR DATA VIEWS

To make sense of all the items you have entered into categories, Commence provides four basic ways to view your database of personal information. The Calendar view lays out time-and-date-based information such as appointments. The Book view uses an address book metaphor; click on the page marked R, and Commence displays an alphabetized list of all entries that begin with that letter. The Gantt view displays information as a Gantt chart. The Report view displays data in a row-and-column format.

Commence comes with seven preconfigured views, each of which applies a view type to a category. The calendar view, for example, displays Appointment-category data in a familiar grid format. Creating additional views is an easy process, and it encourages a creative approach to information; appointments, for instance, can be viewed in the standard calendar format, in a time line–style Gantt chart, or in a tabular view.

Views can be selected instantly from an icon bar at the left border of the Commence screen. If you create a calendar view, a Gantt view, and a report view of your appointments, you can switch among them instantly by clicking on the icons.

SECRET AGENTS

The emphasis on views in Commence is heavier than it was in Current, but a far more fundamental change is the introduction of a powerful automation function that Jensen-Jones calls *agent* technology. An agent consists of a *trigger* and a resulting *action*.

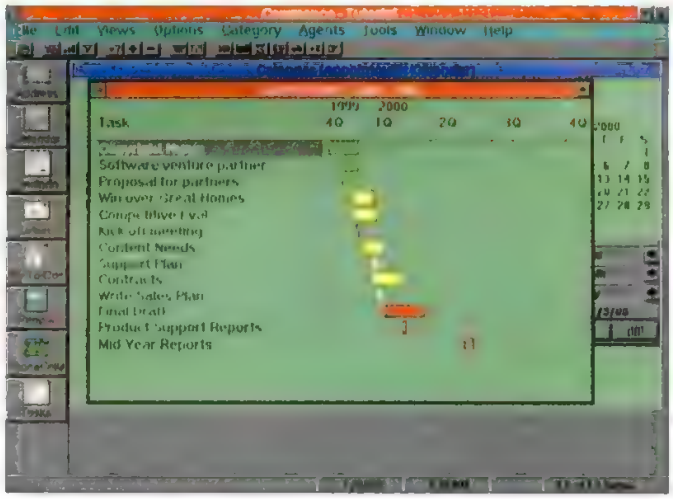
An agent can be triggered by a variety of conditions. A time of day can prompt an agent to take action, and certain events, such as the addition of an item, can also trigger an agent, as can a DDE message from a Windows application.

Once triggered, an agent can perform a wide variety of powerful actions, from merely displaying a message to creating or modifying an item in response to changes in another item. If you enter a to-do item, for example, an agent can automatically create a corresponding appointment entry that will show up on your calendar. Agents can also print data items, views, or letters; launch other software; and send DDE messages to other Windows apps.

While there is no programming required (in the usual sense), creating a very complex agent can be a fairly involved process. Creating simple to moderately complex agents, however, should be well within the capability of any reasonably experienced PC user.

INCOMPLETE SEARCH

Commence's one significant weakness is its search facility. To search for a specific item or subset of items within your database, you specify a search filter. Although a variety of search criteria are available, only the active view can be searched. There is no way to search across all categories and views for a single item, so if you don't remember where you put Mary Smith's phone number, you can't ask Commence to search its entire database to find it. A PIM should not require you to keep track of where a specific item is stored; the program should just cough up the information.



THE BIG PICTURE: *A Gantt chart is one view type you can apply to Commence data. The icon bar at left accesses more views.*

FACT FILE

Commence, Version 1.0
Jensen-Jones Inc., Parkway 109 Office Center, 328 Newman Springs Rd., Red Bank, NJ 07701; 800-289-1548; 908-530-4666

List Price: $395 ($295 through 12/31/92), upgrade from IBM Current, $99
Requires: 2MB RAM, 3MB hard disk space Microsoft Windows 3.0 or later
In Short: Commence builds on IBM Current through the addition of powerful automation facilities. This is a versatile PIM that can be extensively customized and personalized
428 ON READER SERVICE CARD

Effective use of Commence requires that you have a good understanding of the hierarchy of items, categories, and views. You may find that you spend more time learning the product than you would with less complicated packages such as the DOS-based Instant Recall. But the investment of effort pays off handsomely, and the learning process is greatly simplified by crystal-clear documentation and an excellent tutorial.

Commence excels at creating and managing links between the various bits of information that pile up on the desks of modern professionals. It presents an array of instantly usable tools, and it can be developed into a uniquely personal information management system by anyone willing to invest a little effort. □

Four out of five 1-2-3 users prefer Quattro Pro

When a group of Lotus 1-2-3 users compared Quattro® Pro 4.0 and 1-2-3 side-by-side, they made a startling discovery: four out of five Lotus users preferred Quattro Pro. They found it easier to use, richer in features, and more productive. The study was done by Usability Sciences Corporation, a highly regarded independent testing laboratory. (Coincidentally, this is the same company Lotus uses to do its usability studies.)

Borland dumps old Lotus menus, keeps macro compatibility

About 90% of Quattro Pro users use only the Quattro Pro native menus. They no longer use the old Lotus slash key. And it's now obvious that Lotus doesn't want other companies supporting its outdated user interface either. Therefore, Borland has decided to give users what they prefer. Borland is now shipping Quattro Pro 4.0 with only the more efficient native menus—the ones users love. And Quattro Pro still has 1-2-3 file, publishing style, and macro compatibility.

The final mistake: Lotus goes it alone

Lotus' latest strategy of closing the menu-command standard is the final blow to users. After all, what is Lotus known for? *The best technology?* Certainly not. *The best spreadsheet?* Not even close. *Litigation rather than innovation?* Absolutely. And now Lotus is on the verge of losing its largest asset: users who have invested in the Lotus menu standard. By making its menu system a closed standard, Lotus is not the only loser. You lose, because Lotus is apparently trying to eliminate your right to choose. Fortunately, you don't lose much, because 1-2-3 users prefer Quattro Pro's better design and Quattro Pro can still run their 1-2-3 macros.

Quattro Pro 4.0 is . . .

". . . the best DOS spreadsheet you can buy."
PC/Computing, March 1992

". . . the ultimate DOS spreadsheet."
PC Magazine, April 28, 1992

". . . the best non-Windows spreadsheet . . ."
PC World, March 1992

". . . the best DOS spreadsheet ever."
Office Technology Management, February 1992

"The best DOS spreadsheet in the world."
PC User (U.K.), March 24, 1992

Lotus closes standard, loses the war

So Lotus may have won a small battle by keeping a menu system to themselves, but they'll lose a very big war with their Berlin Wall customer strategy. Borland, on the other hand, has always believed that open standards promote competition, spur innovation, and grow markets.

Lotus and Ashton-Tate: history repeats itself

Ashton-Tate® tried to establish a closed standard too. They tried to force users into their camp and to keep out the competition through litigation. Borland's acquisition of Ashton-Tate reversed this. Borland dropped Ashton-Tate's lawsuit against Fox and paved the way for competing products from several companies. Customers have won, because they can freely choose other products compatible with the open dBASE® standard.

Quattro Pro: the best DOS spreadsheet

Quattro Pro has won 42 awards, dwarfing Lotus in side-by-side comparisons. And Quattro Pro 4.0 has been called the best DOS spreadsheet by leading computer trade publications. It's proof that competition works.

You be the judge

For a good lawyer, call Lotus' law firm. For the best DOS spreadsheet, get Quattro Pro.

See your dealer today or call Borland at 1-800-331-0877, ext. 6502

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OS/2 Development

Gpf 2.0: First 32-Bit GUI Development Tool for OS/2

BY JOE SALEMI

OS/2 2.0 users are still waiting for the flood of 32-bit applications that will take full advantage of the new operating system. With Gpf, Version 2.0, Gpf Systems hopes to help the flood along by speeding up the development process. This $995 programmers' tool makes it easy to create graphical 32-bit applications for the Presentation Manager Workplace Shell.

Gpf, which stands for GUI Programming Facility, is a 32-bit interactive tool and application generator that uses a series of menus, dialog boxes, and buttons to help programmers create the application's interface and actions. Though Gpf itself is not object-oriented, it does give the programmer access to the Workplace Shell's objects (such as icons, settings menus, and a task list), its new user controls (a notebook, spin button, slider, container, and value set), and OS/2's drag-and-drop interface.

DESIGN IN, C CODE OUT

As you build windows, dialogs, and controls, Gpf completes the navigation code and logic, creates context-sensitive help, and links them both to the object. It even generates embedded SQL code.

Gpf gives you complete control over the appearance of your application's screen. You can add icons and bitmaps to any object or screen; specify different fonts and colors for different text items, including the text in pull-down menus; and change how the mouse pointer appears depending on the action being taken.

When the application is complete, Gpf generates all the ANSI C files needed to handle the user-interface portions of the application: headers, source code, resource files, help files, and application definition files. It even creates a MAKE file and linker response file that can be used with any of the supported C compilers, and a .CMD file (the OS/2 version of a batch file) to automate the compilation process. You'll have to add your own code to carry out the application's tasks, as Gpf's primary job is to write the screen-handling code. By modifying Gpf's code through an external text editor, you can add your own routines. You can also add code for new or preexisting functions to Gpf's environment as a User Function Object, and Gpf will automatically include the functions in the code it generates.

The compiler you're using is specified in the application definition box; unless you need to add some specialized routines or functions, the code can be compiled as is, and the application is ready to run. The source code Gpf creates is heavily commented, which makes it relatively easy to modify.

Gpf currently supports the IBM C Set/2 compiler for creating 32-bit and 16-bit applications, and Microsoft's C 5.1 or 6.0 for creating 16-bit applications. Gpf Systems has promised updates to support other 32-bit C compilers, such as those from Borland International and Watcom, as they become available. Supported compilers can be run directly from a pull-down menu on Gpf's main screen; others are run from the OS/2 command line.

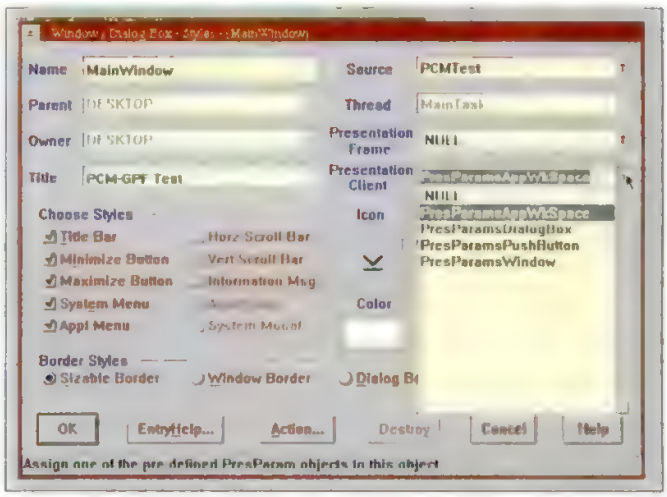
PROTOTYPE TESTING

Gpf also provides a rich environment for testing your applications. There are two ways you can test a program under development: the test mode and the Gpf Animator. The test mode runs from a pull-down menu and is used primarily to make sure the application's menus and buttons do what they're supposed to do. While you are in the test mode, the rest of the Gpf development environment remains active. This lets you easily switch back to the development environment, make a change to the program, and immediately run another test.

The Animator is more sophisticated: It minimizes Gpf and runs your application in a separate OS/2 process as if it were already compiled. This enables you to see exactly how the program will look and work—including navigation and SQL links—from the user's perspective. Animator can be run within Gpf or directly from OS/2.

Using Gpf, we were able to create and compile two simple Presentation Manager applications in the course of an afternoon. Gpf makes it easy by shielding the programmer as much as possible from all the different OS/2 and Presentation Manager program functions; all you have to do is paint or describe the application's menus and actions on the screen, and Gpf handles the rest.

Gpf is an incredibly useful tool for both the beginning and the experienced OS/2 programmer and greatly speeds up the application development process. The only thing missing is more built-in compiler support, which is not the fault of Gpf Systems; it's up to the compiler vendors to get their 32-bit compilers out on the market so Gpf Systems can add them to its support list. Anyone who is serious about writing OS/2 applications should make Gpf part of his programming toolkit. □



OS/2 APPS: *Gpf makes it simple to create sophisticated 32-bit OS/2 programs by guiding you through dialog boxes that define the appearance and actions of the final application.*

FACT FILE

Gpf, Version 2.0
Gpf Systems Inc., 30 Falls Rd., P.O. Box 414, Moodus, CT 06469-0414; 800-831-0017, 203-873-3300; fax, 203-873-3302

List Price: $995
Requires: 6MB RAM, 4MB hard disk space, OS/2 2.0, IBM C Set/2 compiler for creating 32-bit applications or any ANSI-compatible compiler for creating 16-bit applications
In Short: Gpf, Version 2.0, is a sophisticated OS/2 application development tool and code generator that makes it easy for any programmer to create Workplace Shell applications
420 ON READER SERVICE CARD

THIS IS THE PRINTER

THAT PRINTED THE PROPOSAL

THAT CLINCHED THE DEAL

THAT PUT A NEW CLIENT ON THE ROSTER

AND MIKE ROGERS' NAME

ON THE DOOR.

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IT'S EASY TO SPOT FAULTY DISKS. COMPUTERS SWEAR BY THEM.

Computers are smart. Use a bad disk, and they'll tell you. With a pointed message like the one you see on the screen above. Now, you can do one of two things. Swear right back at your computer. Or start using BASF disks. Made by the people who invented magnetic recording.

BE SAFE. BASF.

BASF

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Communications

Brown-Wagh's 3D Workshop Brings 3-D Animation to the Masses

BY ROBERT KENDALL

Nothing can add pizzazz to a multimedia presentation like 3-D animation, but until now this kind of showmanship has come at a hefty price. Fortunately, with Brown-Wagh Publishing's $299.95 3D Workshop you can get started in high-resolution 3-D animation without breaking your bank.

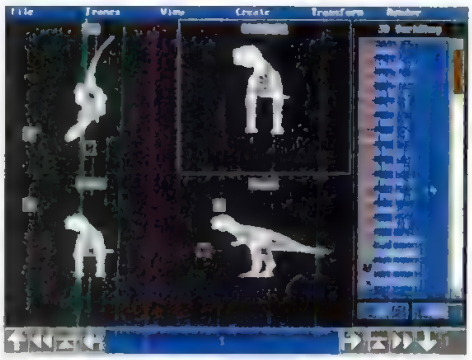
3D Workshop lets you work with all the basic elements of 3-D animation, including maneuverable light sources and camera positions. As with its high-end counterparts (the $2,995 Autodesk 3D Studio, for example), 3D Workshop's learning curve and hardware requirements are steep. You will want to have a fast 386 with a math coprocessor—or preferably a 486 machine.

KEYFRAMING

3D Workshop relies on vector-based keyframing. Within frames you position objects, light sources, and cameras (which determine the vantage point of the animation) and define the movements and transformations you want. The program generates the intervening frames. In keyframing, you work with wireframe images of your objects to speed things up. Since you're working with vectors, it is easy to make alterations to the images.

The final step is rendering the animation with the proper shading. The results look great, and the images capture the effects of light on surfaces, but rendering can take hours.

3D Workshop gives you a variety of options for animating objects in three dimensions. You can move them along straight, curved, or circular paths and scale them or spin them on any axis. You can also create hierarchical links among objects so they will move together in your animations.



3-D MOVEMENT: *Position wireframe objects, light sources, and cameras.*

Object creation is 3D Workshop's biggest weakness. The program's incredibly crude drawing tools are adequate for creating only the simplest shapes, and there is no practical way to create text.

Fortunately, the package will import objects in Autodesk's .DXF format. It also comes with a sampling of 3-D clip art, and a library of objects will be available soon.

PLAYBACK

3D Workshop includes a runtime playback utility, and it will export its animations as Autodesk Animator .FLC or .FLI files or as PhotoRealistic RenderMan .RIB files. You can also save animations as a series of files in .BMP, .GIF, .PCX, or TIFF format.

3D Workshop offers some unique and impressive capabilities for its price, but its insufficient drawing tools and import capabilities make it of limited practical value to anyone without a CAD package that creates .DXF files. A forthcoming Microsoft Windows version should overcome these liabilities by supporting TrueType and importing standard graphics formats.

• List Price: *3D Workshop, Version 1.0, $299.95.* Requires: *640K RAM (2MB recommended), DOS 3.2 or later, mouse; 25-MHz 386 PC or better, math coprocessor recommended. Brown-Wagh Publishing, 160 Knowles Dr., Los Gatos, CA 95030; 800-451-0900, 408-378-3838; fax, 408-378-3577.*

Circle 425 on reader service card

Utilities

EDOS: For DOS Users in Power Windows

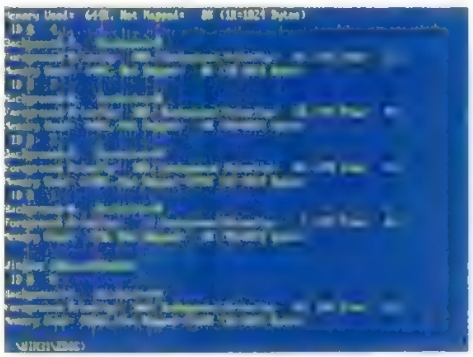
BY BARRY SIMON

Wouldn't it be nice to start a lengthy batch file in a Windows DOS session, switch to a Windows app, and have a message pop up when the batch file is done? That's just one of the capabilities you gain with Firefly Software Systems Corp.'s $39.95 EDOS, a utility that enhances your DOS sessions when you're running Windows 3.0 or 3.1 in 386 Enhanced mode.

EDOS adds roughly 20 new commands to your DOS sessions and one new hotkey; it also adds intelligence to PrtSc. Through the magic of Windows virtual device drivers (VxDs), it uses no conventional memory in individual DOS sessions.

One group of extra DOS commands lets you change PIF settings on the fly. A Background On command in a batch file will let that session run when switched to the background.

Windows modifies PrtSc in DOS sessions to send the current screen to the Windows Clipboard instead of sending it to the printer. EDOS gives you the best of both worlds: Plain PrtSc goes to the printer and Alt-PrtSc to the Clipboard. EDOS also disables many commands that can be dangerous under Windows.



PIF VIEW: *Change settings on the fly.*

While our testing on a straight Windows setup was uneventful, there were some unexplained crashes when many Windows utilities were running in a DOS session and lots of TSRs were active. Firefly Software is investigating these conflicts.

The functionality of EDOS is useful, but its potential is even more exciting. There should be more hotkeys and more inventive new commands. Also, EDOS's setup utility is a little weak. It removed the multimedia driver from our Windows SYSTEM.INI, and we had to reinstall the driver manually.

These glitches should not stand in the way of the main point: EDOS gives DOS users who are venturing into the world of Windows remarkable new powers.

• List Price: *EDOS, Version 3.01, $39.95.* Requires: *Microsoft Windows 3.0 or later. Firefly Software Systems Corp., P.O. Box 5035, Oregon City, OR 97045; 800-248-0809, 503-694-2282.*

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CIRCLE 148 ON READER SERVICE CARD

New & Improved

NEWS OF ANNOUNCED PRODUCTS AND UPGRADES

By Emerson Andrew Torgan

IMPROVED

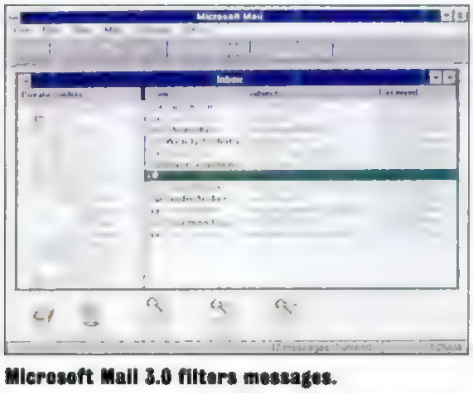
Microsoft Mail 3.0 Gains OLE, Global Address List

Microsoft is now shipping the much-anticipated upgrade to its e-mail program, with new features that include OLE (Object Linking and Embedding) support; a global address list; and mail-enabling of Microsoft's Excel, Word, and PowerPoint (allowing users to send messages while working in those applications). The upgrade also has a built-in spell-checker, along with message finders that let users filter messages by subject, sender, recipient, message content, or any combination of those criteria.

Microsoft Mail 3.0 lets users place file attachments anywhere within a message. Recipients can double-click on the attachment icon to launch the appropriate application and automatically load the file. Files can be attached by drag-and-drop from the Windows File Manager. Current users of Microsoft Mail can update for $295 per server.

• List Price: *Microsoft Mail, Version 3.0, starter pack with server module and ten workstation licenses, $695. Microsoft Corp., One Microsoft Way, Redmond WA, 98052; 800-227-4679, 206-882-8080; fax, 206-936-7329.*

Circle 402 on reader service card



Microsoft Mail 3.0 filters messages.

NEW

Get Your Kicks on Route 66: 66-MHz DX2 Systems Peel Out

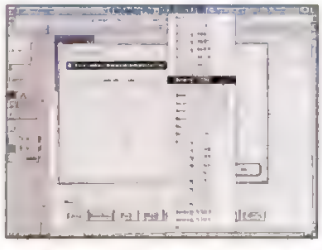
If you thought that the 50-MHz 486DX2 chip was a wild ride, then buckle your seat belts and put both hands on the keyboard. **Intel**'s 66-MHz 486DX2 processor is here. According to the manufacturer, systems using the new speed-doubling chip with the 33-MHz system clock can execute applications up to 70 percent faster than systems using the 33-MHz 486DX processor. One of the first companies to unveil systems based on Intel's new speed demon is **Dell Computer Corp.**

The low-profile Dell System 486P/66 and the midsize 486D/66 are the new additions to Dell's line of upgradable ISA-based 486 desktop systems. The 486P/66 has three 16-bit expansion slots, and is available configured with 4MB of RAM and a 120MB hard disk or 8MB of RAM and a 230MB hard disk. The 486D/66 provides six 16-bit expansion slots and is configured with 8MB of RAM and a 230MB hard disk. Two new EISA-based systems, the 466DE (a desktop model with five 32-bit expansion slots) and the 466SE (a tower model with eight 32-bit expansion slots) are available configured with 8MB of RAM and a 230MB hard disk. For a list of companies that have announced support for the new Intel 66-MHz 486DX2 processor, please see Briefs, page 64.

• List Price: *Dell System 486P/66, $2,499; Dell System 486D/66, $3,249; Dell System 466DE, $3,899; Dell System 466SE, $5,449. Dell Computer Corp., 9505 Arboretum Blvd., Austin, TX 78759; 800-289-3355, 512-338-4400; fax, 512-338-8421.*

Circle 403 on reader service card

HOT PROSPECT



Claris Enters Windows Market With FileMaker Pro Database

Claris is setting the standard in cross-platform compatibility with the release of FileMaker Pro 2.0 for Windows, the company's first internally developed product for the PC platform. A popular flat-file database for the Macintosh, FileMaker 2.0 arrives as virtually identical twins—one for the Mac and one for Windows—that share 85 percent common code; both also work and look alike.

FileMaker 2.0 for Windows offers a customizable toolbar, relational links, a text editor, customizable fields and reports, and mail-merge capabilities. The ScriptMaker, a mouse-driven scripting interface, lets users automate tasks, menu operations, and procedures without syntax or compiling. Users select desired steps and options from scrolling lists and pop-up menus. Field formats such as radio buttons, check boxes, and pop-up lists speed data entry, according to Claris. Users can work with up to 16 files open simultaneously, search and filter information via any user-defined layout, and select and retrieve information based on any defined criteria for indexing. The package ships with a number of predefined templates for common business needs such as invoicing, mailing lists, and lead tracking.

• List Price: *FileMaker Pro 2.0 for Windows, $399. Claris Corp., 5201 Patrick Henry Dr., Box 58168, Santa Clara, CA 95052; 800-325-2747, 408-987-7000.*

Circle 401 on reader service card

IMPROVED

Definitions Plus! Update Gets New Name: Instant Definitions

WordScience is shipping an update to Definitions Plus!, with new features and a different name. Instant Definitions, Version 3.0, is a DOS-based pop-up dictionary requiring only 4K of RAM. The package gives users quick access to the 116,000-word *American Heritage Dictionary*, Office Edition, from Houghton Mifflin Co.

New to Instant Definitions is the DictionaryScan feature for finding new or forgotten words by entering a word or part of a definition. The Compare feature displays and compares two words and their definitions. Browse lets users scroll through a list of words alphabetically, while the first few lines of the definition appear in a separate box. When spell-checking a document, the Spell Helper feature not only displays the correct spelling of a target word, but the definition as well.

• List Price: *Instant Definitions, Version 3.0, $69; network version, $149.75 for 5 users. WordScience Corp., 1415 Oakland Blvd., #220, Walnut Creek, CA 94596; 800-869-9673, 510-939-1190.*
Circle 404 on reader service card

IMPROVED

DesignCAD Professional Bundle Combines 2-D and 3-D Versions

American Small Business Computers' DesignCAD Professional consists of DesignCAD 2D, Version 5.0; DesignCAD 3D, Version 4.0; the ScanPRO raster-to-vector conversion utility; the DesignSYM Professional Symbols Library; the SmartEST Estimating Program; and three training videos.

DesignCAD 2D lets users create two-dimensional drawings and has pull-down menus and over 200 commands. DesignCAD 3D is a three-dimensional solid-modeling package that provides Boolean operators, shading, a materials library for surface textures, and an improved BasicCAD programming language. The ScanPRO utility converts paper drawings into DesignCAD drawings. DesignSYM Professional Symbols Library has over 6,700 predrawn symbols. SmartEST Estimating Program creates estimates or bids for work.

• List Price: *DesignCAD Professional, $995. American Small Business Computers Inc., One American Way, Pryor, OK 74361; 918-825-4844; fax, 918-825-6359.*
Circle 405 on reader service card

IMPROVED

GoldMine Gains Group Scheduling, Remote Transferring

ELAN Software is now shipping an update to its contact management software package featuring a new group-scheduling facility that lets you schedule users and resources, find available time, and confirm availability via R.S.V.P. verification. GoldMine, Version 2.5, also has a new Smart Remote Transfer feature for remote updates of contact information, including notes, client history, calendar, and messages. Contact database screens are user-definable, and the package has expanded storage and print merging facilities for supplementary contact information. A new two-tiered security system allows records to be designated as either "owner" (private) or public.

GoldMine provides group scheduling facilities.

• List Price: *GoldMine, Version 2.5, $295; $895 for network version. ELAN Software Corp., 4917 Gerald Ave., Encino, CA 91436; 800-654-3526, 818-999-9872; fax, 818-999-9903.*
Circle 406 on reader service card

NEW

Eclipse FAX Takes On Windows Fax Software Leaders

Eclipse Systems is directly challenging Delrina's WinFax Pro with its Windows-based fax package, Eclipse FAX, Version 1.0. The company says the program's new fast fax display and rotation provide users with desktop publishing capabilities, file management, and scanner support, and let users mark up incoming faxes with lines, boxes, circles, arrows, and freehand drawings. Text can be typed on fax images with all Windows fonts, then rotated to any angle. Marked-up faxes can be sent back or forwarded without exiting the program.

Eclipse FAX provides WYSIWYG thumbnail-view editing, indexing, a ClearView gray-scale anti-aliasing feature for displaying fine-print faxes on ordinary VGA monitors, and a QuickRead feature that displays faxes a half page at a time. The program supports Class 2 and CAS fax/modems; Fax Groups 3 and 4; in addition to .DCX, .PCX, and TIFF image file formats.

• List Price: *Eclipse FAX, Version 1.0, $119. Eclipse Systems Inc., 33 W. Monroe St., #1121, Chicago, IL 60603; 800-452-0120, 312-541-0260; fax, 312-541-0514.*
Circle 407 on reader service card

NEW

Zenith Data Systems Unveils Vision of the Future

This is not your father's computer. The striking white Z Series machines from **Zenith Data Systems** are constructed with an emphasis on integrated connectivity, modularity, and a common design revealing the company's vision of PCs that are yet to come. The line consists of notebook PCs, desktop PCs, file servers, and monitors.

BRIEFS

66-MHz 486DX2 Systems

The following companies have announced support for Intel's 66-MHz 486DX2 processor.

AST Research intends to take advantage of Intel's 66-MHz speed-doubler technology. 800-876-4278, 714-727-4141; fax, 714-727-9355.

Caliber Computer has announced their Smart 486DX2-66 EISA and Smart 486DX2-66 ISA systems based on the 66-MHz 486DX2 processor, each featuring 4MB RAM and a 210MB hard disk. The EISA system supports up to 128MB RAM and a secondary cache of up to 512K. The ISA system supports up to 128MB RAM and a secondary cache of up to 256K408-942-1220;fax,408-942-1345

Digital Equipment Corp. has announced the DECpc 466ST, powered by the 66-MHz 486DX2 processor. The system is priced at $4,319 and includes 4MB RAM, a 245MB hard disk, a 3.5-inch 1.44MB floppy disk drive, a keyboard, and a mouse. 800-722-9332; fax, 508-486-6422

Epson will have a configuration of its 486/Wingine PC featuring the 66-MHz 486DX2 processor. 800-922-8911, 310-782-0770; fax, 310-782-5220.

Everex Systems has introduced four new PCs based on the 66-MHz 486-DX2 processor: the STEP Megacube 486DX2/66e, the STEP 486DX2/66e Tower Model, and the STEP 486DX2/66e Desktop Model. All three 32-bit EISA systems feature the company's proprietary Advanced Memory Management Architecture and support a write-back cache scalable to 256K. Everex has also introduced the Tempo Standard 486DX2/66 ISA desktop system. 800-821-0806, 510-498-1111.

Gateway 2000 has unveiled a new local bus video system based on the 66-MHz 486DX2 processor. The $2,995 PC has a 340MB hard disk. 800-523-2000, 605-232-2000; fax, 605-232-2023.

WHEN IT COMES TO PERFORMANCE AND VALUE, the products of one company have consistently caught the fancy of users and industry experts. The editors of *PC Magazine* chose MAG InnoVision product three years running. Clearly, they like what they see. So will you. OUR MICROPROCESSOR-BASED MX15F (15") and MX17F (17") feature the latest flat square tube with Invar Shadow Mask technology for bright, distortion-free images. Overscanning allows edge to edge active display, while on the MX17F, dynamic focus circuitry maintains focus across the entire screen area. High resolution – up to 1280 x 1024 non-interlaced opens additional Windows work space.

FIND OUT MORE. Contact us at 1-800-827-3998, or 4392 Corporate Center Drive, Los Alamitos, CA 90720. Tel: 714-827-3998. Fax: 714-827-5522.

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CIRCLE 067 ON READER SERVICE CARD

MAG INNOVISION

Graphics Compromises

Let ATI's New GRAPHICS ULTRA Cards Pump You Up.

Today's graphics cards grind you down to their level, forcing you to give up speed for resolution, or resolution for realistic color. But why get bull-dozed into a compromise? ATI's new GRAPHICS ULTRA cards give you all-round performance... speed, color and resolution all at the same time.

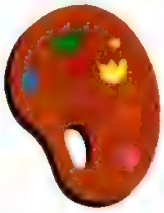
25.5m WIN MARK

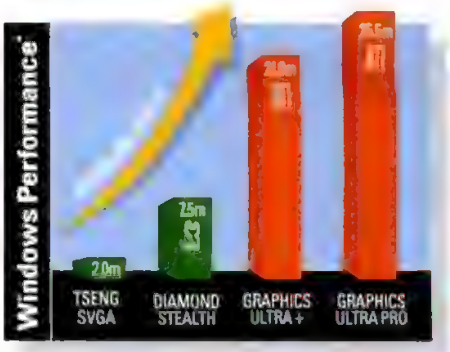
Top Speed: 25 million WINMARKS*

Competing S3 solutions decelerate your display with slow data transfer rates and plodding VGA performance.

ATI's new GRAPHICS ULTRA cards are up to three times faster; leaving even local-bus solutions behind in the dust. Our second-generation mach 32 graphics processor and linear addressing design give *concrete* performance, up to a remarkable 25 million WINMARKS.*

Loaded with 2.0MB of video memory, ATI GRAPHICS ULTRA cards give you solid colors, without squashing your display down to pedestrian resolution. Run 1024x768 with 65,000 colors, at accelerated speed. Or work in true 24-bit color, at up to 800x600. All at refresh rates up to 76Hz for flicker-free graphics.





Our single Windows driver supports painless mode switching, plus an expanded Virtual Desktop, for convenient scrolling and panning. And you get laser-quality display

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with ATI's hardware-accelerated True Type font scaling and smoothing, courtesy of our exclusive CRYSTAL Font technology.

mach 32

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ATI GRAPHICS ULTRA cards accelerate the latest multimedia applications,** with hardware decompression and direct color modes. Hardware-assisted "StretchBlt" image scaling lets you widen video images to full-screen with no slowdown.

Resolution and Color Support	ATI	S3	SVGA
1024 x 768 / 65,000	■		
1024 x 768 / 256	■	■	■

Two-Way Stretch

ATI gives you two ways to construct the perfect solution. The GRAPHICS ULTRA PRO uses VRAM for the ultimate fast-lane performance, at workstation resolutions up to 1280x1024 non-interlaced. The GRAPHICS ULTRA+ uses a highly optimized internal architecture and less expensive DRAM to provide amazing speed at a price that definitely won't leave you flat broke.

GRAPHICS ULTRA +

- Fast 21.0 million WINMARK* performance
- Accelerated 1024 x 768 at 65,000 colors
- True color (16.7 million) at 800 x 600
- Available in 2.0 MB or 1.0 MB versions
- Priced from $399.00***

GRAPHICS ULTRA PRO

- Fast 25.5 million WINMARK* performance
- Accelerated 1280 x 1024 at 256 colors non-interlaced at 74 Hz refresh rate
- Available in ISA, EISA or MicroChannel versions
- Priced from $599.00***

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Perfecting the PC

Copyright © ATI Technologies Inc., 1992. All company and/or product names are trademarks and/or registered trademarks of their respective manufacturers. *Winbench 2.5 on 486-33 at 1024 x 768 / 256 colors at 60 Hz. **Multimedia drivers available 11/92. ***Suggested Retail Prices in US$. Dealers may sell for less. Prices subject to change without notice. Awards based on award-winning technology of GRAPHICS ULTRA and VGA WONDER.

CIRCLE 337 ON READER SERVICE CARD

The Z-Station line of 19 desktop systems ranges in price from $1,699 to $3,799, and is available in ISA or EISA configurations with two- or four-slot chassis. Processors range from a 25-MHz 386 to a speed-doubled 50-MHz 486DX2. All feature an Ethernet-based NE2000-compatible LAN module and three network client shells (NetWare, LAN Manager, and VINES) preinstalled on the hard disk. The Z-Server EISA tower models that function as network servers range in price from $4,399 to $8,399 and are available with processors ranging from a 25-MHz 486SX to a 50-MHz 486DX. The units have an accessible modular architecture with eight expansion slots, letting users snap drives in and out of place.

• List Price: *Z-Station 325Sh Model 80, $1,699; Z-Server 425SE Model 1, $4,399. Zenith Data Systems, 2150 East Lake Cook Rd., Buffalo Grove, IL 60089; 800-553-0331, 708-808-5000.*
Circle 408 on reader service card

IMPROVED

Untouchable Escalates the Battle Against Viruses

Fifth Generation Systems' Untouchable, Version 1.1, now provides expanded generic disinfection algorithms, enhancing the program's ability to detect unknown viruses without relying on virus signatures. The update also includes the company's new Smart File Access Technology, for combating stealth viruses that hide beneath preinfection file size and date information during the scanning process. Untouchable is available in standalone and network versions. The program provides scanning of compressed files and protection against self-mutating viruses that infect files in a different way each time.

• List Price: *Untouchable, Version 1.1, $99; Untouchable Network, Version 1.1, $695 for 10 users. Fifth Generation Systems Inc., 10049 N. Reiger Rd., Baton Rouge, LA 70809; 800-873-4384, 504-291-7221; fax, 504-295-3268.*
Circle 409 on reader service card

NEW

PenMate Brings Pen Computing to The Desktop Environment

For those of you suffering from "pen envy," **Mouse Systems** is offering a way to experience pen computing without purchasing a pen-based system. PenMate is a new alternate input device that features a pen stylus and a desktop tablet, or "work pad."

The $349 unit comes bundled with Microsoft Windows for Pen Computing, providing handwriting recognition capabilities and pen-based applications. Fully Summagraphics tablet– and Microsoft mouse–compatible, PenMate ships with Mouse Systems' user-definable command strip utility software for frequently used Windows commands.

• List Price: *PenMate, $349. Mouse Systems Corp., 47505 Seabridge Dr., Fremont, CA 94538; 510-656-1117; fax, 510-656-4409.*
Circle 410 on reader service card

PenMate ships with Windows for Pen Computing.

BRIEFS

66-MHz 486DX2 Systems

Hewlett-Packard's HP Vectra 486/66U system features local-bus video and the 66-MHz 486DX2 processor. 800-752-0900.

NCR's new NCR StarServer E model 660 features the 66-MHz 486DX2 processor. The StarServer E is a multiprocessor system operating in an open systems environment as either a LAN-based workgroup server or a multiuser system. A typical StarServer E model 660 configured with two processors is priced at $62,000, and has up to 512K of external cache on each 66-MHz processor, memory interleaving, a SCSI-2 host adapter, 512K of SCSI cache (expandable to 16MB per host adapter), and 512K error-correction code memory. 800-225-5627, 513-445-5000.

NEC Technologies has unveiled the PowerMate DX2/66e and the PowerMate DX2/66Te EISA systems, based on the 66-MHz 486DX2 processor. New systems feature 128K of secondary CPU cache, 8MB RAM (expandable to 256MB), a dedicated 128-bit memory bus to support zero-wait-state memory access, and 486 burst-mode operation. The PowerMate DX2/66e comes configured with no hard disk ($3,549), a 240MB hard disk ($4,099), or a 535MB SCSI hard disk ($4,999). The PowerMate DX2/66Te comes configured with no hard disk ($6,599), a 535MB SCSI hard disk ($8,049), or a 1.35GB SCSI hard disk ($9,249). 800-388-8888, 508-264-8000; fax, 800-366-0476.

PC Brand's new 66-MHz 486DX2-based PC Brand Leader 486/DX2-66 Cache is priced starting at $2,495, and comes standard with a 64K cache, 4MB RAM (expandable to 32MB), and a 105MB hard disk. 800-722-7263, 805-378-6069; fax, 800-722-7393, 805-378-7801.

Swan Technologies has introduced the Swan 486DX2-66E EISA system, featuring the 66-MHz 486DX2 processor. The system has Flash EPROM. 800-468-9044, 814-238-1820; fax, 814-237-4450.

NEW

Samsung Enters New Arena with $1,995 Laser Printer

Samsung is now shipping the Finalé 8000, the company's first venture into the printer market. The 300-dot-per-inch laser printer is based on Intel's 960 32-bit RISC processor running at 16 MHz.

The Finalé 8000 uses Samsung's proprietary 8-page-per-minute print engine, and provides a TrueType rasterizer in conjunction with Type 1 and Type 3 font compatibility to ensure rated output speed in the PostScript or PCL 5 mode, according to the company. It ships in standard configuration with 2MB RAM (upgradable to 18MB), two paper trays, Samsung's proprietary Auto Emulation Protocol and Auto Interface Switching features, two Hewlett-Packard font cartridge-compatible slots, and has a number of emulations.

• List Price: *Finalé 8000, $1,995. Samsung Electronics America Inc., Information Systems Division, 105 Challenger Rd., Ridgefield Park, NJ 07660; 800-446-0262, 201-229-4000; fax, 201-229-4068.*
Circle 411 on reader service card

NEW

Store Valuable Data in the Vault—the QICVault

Tecmar has unveiled a new series of 720MB quarter-inch (QIC) tape backup systems for standalone PCs and LANs, carrying a low price tag. Available in five configurations (both ex-

Now Windows is as easy to use as DOS.

Microsoft® Windows® is capable of great and wonderful things.

But if you're among the many who've traded the frustration of the C: prompt for the graphical confusion of Program Manager, relax.

You're about to discover what half a million delighted DOS® and network users already know.

That the shortest distance between you and your programs is straight through Direct Access.

It's the world's best-selling menuing software. And as soon as you install it you'll understand why.

Direct Access searches your disk, gathers your programs into logical groups and builds menu screens just like the one you see at the top of this page.

All by itself.

That's right. You just load it and forget it.

Whenever you want an application, all you have to do is hit one key.

Or, if you prefer, click one mouse.

The more applications you have on your disk, the more you'll delight in Direct Access.

That's because Program Manager insists on grouping your programs into five arbitrary categories: "Windows Applications," "Non-Windows Applications," "Accessories," "Games" and "Main."

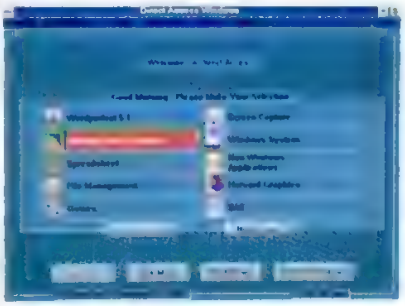
Not very intuitive, eh?

Direct Access, on the other hand, gives you a multitude of utterly sensible program groupings – 17 of them.

And that doesn't count the customized ones you dream up yourself.

What does all this mean to you?

It means you can get to a spreadsheet by simply clicking "Spreadsheet." Summon a word processor by stroking "W." And access a DBMS by selecting, you guessed it, "Database."



Direct Access searches your hard disk, groups your applications logically and generates menus and submenus automatically: All you have to do is point and click.

You can even park your favorite programs right on the main menu and ask for them by name.

Hey, we didn't call it Direct Access for nothing.

If the only PC you're responsible for is the one on your desk, Direct Access is valuable, indeed.

But if you're responsible for a department full of PCs, Direct Access is priceless.

Suddenly all of your Windows and DOS users can follow the same quick, convenient route to their applications.

And if all those PCs are networked, so much the better. Because you can install – and customize – Direct Access on everybody's workstation without leaving yours.

You can decide for yourself precisely who gets access to which menu items.

And prevent novice users from even *looking* at DOS.

There's more. A lot more. So pick up the phone. Dial 1-800-677-1848.

We'll tell you about our one-year money-back guarantee and our vaunted toll-free customer support.

Which you can access directly, 24 hours a day.

FIFTH GENERATION SYSTEMS, INC

CIRCLE 288 ON READER SERVICE CARD

ternal and internal), the QICVault Series supports the DC600 QIC standard.

According to the manufacturer, the entry-level QICVault 720i, priced at $1,139, provides backup speeds of up to 10MB per minute when combined with Tecmar's HDE (High Density Encoding) SCSI adapter board. The high-end QICVault 720ex, priced at $1,889, provides backup speeds of up to 15MB per minute when combined with an HDE Plus, a SCSI adapter board with data compression capability.

• List Price: *QICVault 720i, $1,139; QICVault 720ex, $1,889. HDE adapter board (ISA), $229; HDE Plus adapter board with data compression (ISA), $399. Tecmar, 6225 Cochran Rd., Solon, OH 44139; 216-349-0600; fax, 216-349-0851.*
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IMPROVED

$89 PC-Write Advanced Level 4.0 Focuses on Usability

Quicksoft is shipping PC-Write Advanced Level, Version 4.0, which includes a new button bar to let users access frequently used commands and an Adapt feature for defining document-specific profiles for newsletters, memos, or proposals. A context-sensitive help function lets users read about features not currently in a profile and add them if necessary, and the Customizer (over 200 program default settings) and macro features aid in making this update easier to use. Additional enhancements to the package include column support, improved mail-merge capabilities, and a multiple-windows function that lets users move among up to 10 documents at once.

• List Price: *PC-Write Advanced Level, Version 4.0, $89. Quicksoft Inc., 219 First Ave. North, #224, Seattle, WA 98109; 800-888-8088, 206-286-0452; fax, 206-286-8802.*
Circle 413 on reader service card

NEW

Expansion Board Lets You Mix And Match Different SIMMs

Intel's Above Board ISA, a memory expansion board for ISA-based PCs, provides a maximum of 32MB RAM and zero-wait-state operation when the CPU is accessing memory. Shipping in three configurations ($299 for 0K RAM board, $429 for 2MB RAM board, $629 for 4MB RAM board), the board lets users mix and match SIMMs of different RAM configurations and speeds.

The Above Board ISA optimizes each pair of SIMMs to run at its own fastest speed, rather than running the board at the speed of the slowest SIMM. Memory diagnostics, included with the unit, isolate defective memory, display it graphically, and map it out in 128K increments to allow the remaining memory on the SIMM to be used.

• List Price: *Above Board ISA, $299 (no RAM). Intel Corp., 2200 Mission College Blvd., P.O. Box 58119, Santa Clara, CA 95052; 800-538-3373, 503-629-7354.*
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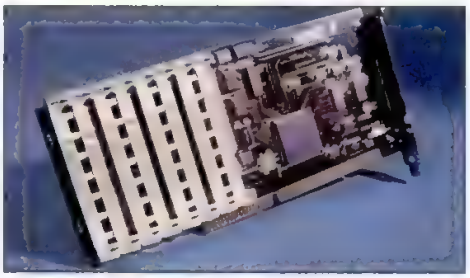

Intel's Above Board ISA.

BRIEFS

Modems

Frecom Communications is shipping eight new Winfast fax/modems, four external and four internal, providing MNP 4 and 5, V.42 error correction, and V.42bis data compression. Four of the units, the Frecom 1-liner Fax/Modem models, let users connect the fax/modem, an answering machine, and a telephone to a single phone line. The units differentiate between voice, data, and fax calls automatically. Prices for Winfast fax/modems range from $399 to $599. 408-955-0555; fax, 408-955-0701.

Hayes Microcomputer Products has unveiled the Optima 96+FAX96 ($419) and the Optima 24+FAX96 ($169) fax/modems. The Optima 96+FAX96 supports V.32, V.22bis, and V.22 protocols, as well as V.42 error correction and V.42bis data compression for data throughput up to 38,400 bits per second (bps). The Optima 24+FAX96 supports V.32, V.22bis, and V.22 protocols, as well as V.42 error correction and V.42bis data compression for data throughput up to 9,600 bps. Both modems support Group 3, V.29, and V.27 for fax transmissions of up to 9,600 bps.

Multi-Tech Systems is shipping three new internal modems for the PC and PS/2 systems. The MT932BC ($899) provides V.32 operation with V.42 error correction, V.42bis data compression, and Group 3 fax support. The MT1432BC (for the ISA PCs) and the MT1432ES (for the MCA-bus PS/2) provide the same features as the MT932BC, with the addition of V.32bis support for data throughput of up to 14,400 bps. Both modems are priced at $999. 800-328-9717, 612-785-3500; fax, 612-785-9874.

NEC Technologies is shipping the UltraLite 14.4 Data/Fax Modem ($699) for the NEC UltraLite SL/20, SL/20P, and SL/25C notebook PCs. The modem supports V.32bis, 9,600 bps send/receive fax transmission, MNP 4 or V.42 error correction, and MNP 5 or V.42bis data compression. 800-388-8888, 508-264-8000; fax, 800-366-0476.

IMPROVED

Communications Package Gains VAX Emulation, TCP/IP Support

FutureSoft Engineering's DynaComm Asynchronous for Windows, Release 3.1, communications software now provides VAX emulation (including DEC VT-340), TCP/IP network support, and a new queue dialer, in addition to supporting a wide variety of binary transfer protocols, network operating systems, and a number of terminal emulations.

The new queue dialer lets users save up to 200 addresses or settings in a dialing directory, including settings for specific phone numbers and different network environments. Support for three TCP/IP networks, including protocols from FTP Software, Novell's LAN Workplace for DOS, and DEC's PathWorks 4.0 is also new.

DynaComm Asynchronous for Windows, Release 3.1, adds new features enabled by Windows 3.1, such as three-dimensional buttons and cascading menus. Enhancements to keyboard remapping include a new scripting feature. Using the keyboard remapping script, users remap keys to execute communications scripts, perform menu commands, or send characters to the host PC. The keyboard mapping feature provides a graphical, point-and-shoot keyboard layout, letting users select keys and functions. A fully configurable tool bar lets you select the icons you want to display.

• List Price: *DynaComm Asynchronous for Windows, Release 3.1, $249; upgrade from previous version, $75. FutureSoft Engineering Inc., 1001 South Diary Ashford, #101, Houston, TX 77077; 713-496-9400; fax, 713-496-1090.*
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CIRCLE 038 ON READER SERVICE CARD

Read Only

REVIEWS OF THE LATEST BOOKS FOR THE PC USER

Edited by Carol Levin

Everyone's Guide to Telecomm Covers Sweeping Changes in Technology

BY ANGELA GUNN

First published in 1990, *Dvorak's Guide to PC Telecommunications* is a compass for telecomm novices and an indispensable reference tool for experienced users. The second edition updates and expands on the previous text and comes with a variety of useful software, including communications and antivirus programs.

This book is *big*—nearly four pounds and over 1,100 pages—and it's gratifyingly comprehensive for first-timers. John C. Dvorak and Nick Anis, along with a number of coauthors for the more specialized material, cover everything from the basics to the complexities of your PC's modem and comm software, along with hot topics like wireless modems, ISDN, and BBS etiquette.

The interest in this book for owners of the first edition lies, of course, in the updates. Information on hardware and software has been revised, and sections have been added on newer topics such as wireless communications, fax technologies, and remote and portable computing. The appendices—the best-thumbed part of the first edition—report such minutiae as on-line access numbers, ASCII and AT codes, and a smattering of BBS numbers (already, by nature, somewhat out of date).

All the best introductory telecomm books these days provide some sort of comm software for those just too excited by the subject to make it to the store. The *Guide* bundles an excellent selection of shareware, including Telix SE, PKZIP, and antivirus software from McAfee Associates. Program documentation, though not complete, is well detailed and spans a quarter of the book.

Times have changed since the first edition of the *Guide* was published. More books on the subject are out, and users with moderate experience will supplement this book with information specific to their interests. But as nearly is possible, the *Guide* is all things to all people. While it won't supplant other telecomm reference books on a good shelf, its breadth and depth give it pride of place.

• *Dvorak's Guide to PC Telecommunications*, Second Edition, by John C. Dvorak and Nick Anis, $39.95. Osborne McGraw-Hill, 2600 Tenth St., Berkeley, CA 94710; 800-227-0900. ISBN: 0-07-881787-0.

Circle 456 on reader service card

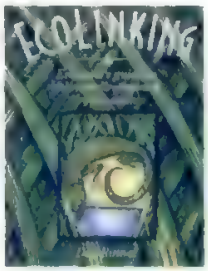
How to Save the Planet by Going Green On-Line

BY SUSAN G. THOMAS

Since the seventies, electronic bulletin boards and networks have hosted on-line conversations ranging from idle chitchat to seismological data distribution. The number of forums has grown so vast that today there's a BBS for just about every special interest. This wide variety can make it hard to find the one piece of information you need.

EcoLinking, by Don Ritter, speaks to the reader who is interested in only one aspect of on-line services: environmental news. It's a terrific sourcebook for anyone who wants either to participate in scientific and political debate on the environment or to research a particular issue. The book does assume, however, a fair degree of technical proficiency on the part of its reader; Ritter provides a basic orientation to communications, but it is by no means complete. Beginners would do well to buy a book on the subject and study it before leaping on-line.

EcoLinking is divided into five sections and five appendices, which list the author's recommended communications software and a sample BBS session. The first section, "Getting Online," covers basic electronic communications. The second, "Global Networks," is a breakdown of major international networks (FidoNet, BITNET, Usenet, and Internet) and on-line university libraries. "Electronic Bulletin Boards" discusses over 30 environmental bulletin boards. The fourth section, "Commercial Online Services," covers networks like EcoNet and CompuServe; and "Libraries That Never Close" explores on-line research databases, CD-ROM alternatives, and on-line news services, such as AP Online and NewsWatch.



All sections describe the philosophy and history of each on-line service, along with details explaining how to get in touch via modem. Case histories illustrate how the services are used in the real world: An electronics engineer used Dialog Information Services' Knowledge Index in order to expose an international recycling fraud; an environmental lawyer currently uses EcoNet to exchange policy ideas with colleagues and also lobbies to exert pressure on the EPA.

EcoLinking is most useful when it lists services by category. The bulletin board section lists echoes under subheads such as "Botany," "Climate," and "Biological Sciences," making it easy for users who already know their fields of interest but don't know how to tap into them electronically. Given his vertical angle, Ritter would have done better to organize the entire book by category. Nonetheless, *EcoLinking* may be the first in a trend toward environmentally-conscious computing. □

• *EcoLinking* by Don Rittner, $18.95, Peachpit Press, 2414 Sixth St., Berkeley, CA 94710; 800-283-9444, 510-548-4393. ISBN: 0-938151-35-5.

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LAN TIMES READERS CHOICE 1992

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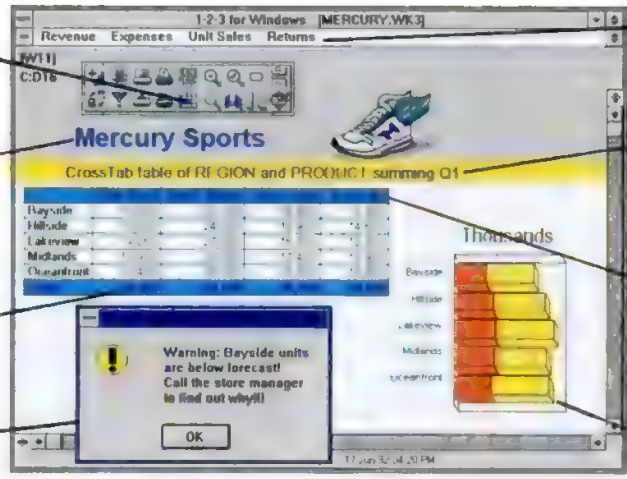

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Lotus 1-2-3 for Windows

*Based on Software Publishers Association data, Q1 1992, for North America. **This disk is free for current users of 1-2-3 for Windows Release 1.1. New buyers of 1-2-3 for Windows Release 1.1 will find SmartPak in their product package at time of purchase. Network version of 1-2-3 for Windows Release 1.1 is available. Please note that the SmartPak Disk works only with 1-2-3 for Windows Release 1.1. ***Please have credit card and product package ready when you call. In Canada, call 1-800-GO-LOTUS. © 1992 Lotus Development Corporation. All rights reserved. Lotus and 1-2-3 are registered trademarks of Lotus Development Corporation. Classic is a registered trademark licensed to Lotus Development Corporation. SmartPak is a trademark of Lotus Development Corporation. Microsoft is a registered trademark and Windows is a trademark of Microsoft Corporation.

Test Drive Your Windows Apps with MSTest

BY JONATHAN WALDMAN

For many developers, the most tedious and time-consuming aspect of software production is testing—a repetitive process of logging malfunctions, noting quirks, and making corrections for each new version that's generated. Microsoft Test (MSTest) can rescue you from some of this tedium by automating and simplifying the testing process.

At the core of MSTest is Test Driver, a Windows-hosted integrated development environment (IDE) that compiles TestBasic code into pseudocode (p-code). TestBasic is like QuickBasic in that it is a procedural language that supports multiple modules, subroutines, and functions; it's like Visual Basic (VB) because it provides access to Windows elements such as dialog boxes, controls, Windows API routines, and DLLs (dynamic link libraries). Unlike current versions of QuickBasic and VB, however, TestBasic supports conditional compilation, and it supports near and far pointer data types—two features advanced programmers will appreciate.

TestBasic is well suited to its task. It can trap UAEs (Unrecoverable Application Errors) and GPFs (General Protection Faults), a necessity for proper testing of Windows 3.0 and 3.1 applications. You can stress-test applications by having one test script temporarily pass control to another or by repeatedly testing (in a loop) a specific part of an application to determine when or if it crashes. For products that have macro languages, TestBasic can run their existing macros as well as pass queued or stored events to an application—something few macro languages can do themselves. If you want a less resource-intensive testing scenario, TestBasic scripts can be compiled and run from the command line instead of from the IDE.

Test Driver is supported by four DLLs: Test Dialogs, Test Screens, Test Event, and Test Control. While each of these furnishes a collection of external procedures, Test Dialogs and Test Screens are accessible through a front end. Test Dialogs provides device-independent comparisons of Windows objects (such as menus, dialog boxes, and controls). Test Screens can capture screens and compare them with images stored in a file, in memory, or in the Clipboard. Its routines are useful for testing bitmaps such as the presentation of a logo or line drawing. Bitmap comparisons, however, only yield a true or false result.

Test Event is a library of functions that simulate sending keyboard and mouse events to an application. Test Control provides functions that can act on a Windows control and report a control's status. For example, a command button can be "pressed," while a check box can be examined for whether it is checked or unchecked.

The Test Driver IDE has both general and context-sensitive help, and uses the Windows Help Engine to provide hypertext links to Microsoft SDK (Software Development Kit) help files. Microsoft, however, doesn't include these files with MSTest. Thus, when you request Windows API Help you may receive an error message indicating a missing file.

The MSTest user's manual is thorough and well written. Strategies for developing a test plan are included along with tips for effectively conducting an exhaustive test cycle. MSTest includes sample scripts, but some were designed specifically for Windows 3.0 and will not run properly under Windows 3.1.

GET A QUICK START

MSTest comes with FastTest, a set of high-level procedures designed to help you create test scripts more easily. The FastTest procedures handle the more mundane tasks of launching applications, logging data, managing files and directories, controlling windows, testing menus and dialog boxes, controlling the mouse, entering any possible keystroke combination, and using the Clipboard. Once you are familiar with FastTest procedures, you can enhance them using the lower-level routines provided by MSTest's DLLs.

You may experience some difficulty testing applications that have controls without captions. Internally, every Windows control has a unique identification number called a handle. Unfortunately, Test Driver locates a dialog element not by its handle but by a caption such as "OK". So MSTest can't confirm that controls without captions—such as list, text, and combo boxes—exist. Thus, in order to locate a text box, for instance, you must first position the cursor to a known control, and then pass keystrokes (such as the Tab key) to the application until the focus rests on the text box. Once the focus is on an object, you can determine the object's class. This approach is unwieldy and sometimes impractical.

Another problem is that some Windows development tools, including Microsoft's own VB, use different class names for native Windows controls. Thus, the CheckBox class is called ThunderCheckBox in a VB application. Since Test Dialogs expects controls to have specific class names, this renders many of its procedures useless. Fortunately, MSTest includes procedures for renaming specific native class names so that they can be properly recognized. Custom controls often have entirely different class names and do not correspond to any native Windows controls. In this case, MSTest cannot confirm the existence of a custom control in a dialog box.

Nevertheless, MSTest is a useful tool for providing immediate feedback about applications that are in production, quickly verifying a program's compatibility with a new release of another product, and removing some of the tedium of testing. □

• Microsoft Test, Version 1.0
List Price: *$395; License Pack (disk and no manuals): $320.*
Requires: *286-based PC or better, 1MB RAM (2MB RAM suggested), 3MB hard disk space, DOS 3.1 or later, and Microsoft Windows 3.x.*
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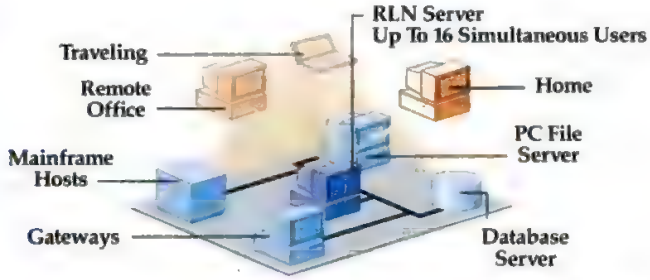

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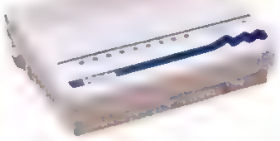

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Michael J. Miller

The Good Word

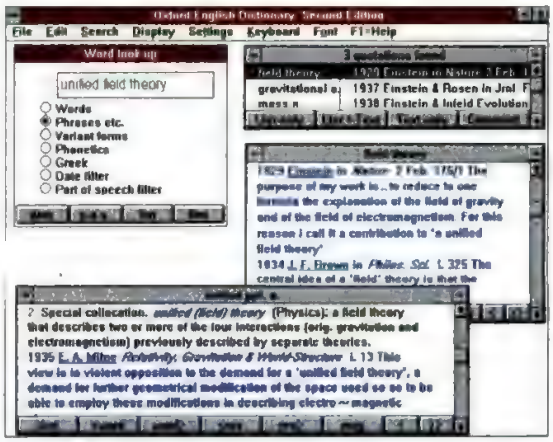
Software developers are an enterprising bunch. Year after year, they find ways to extend our basic applications beyond what we could have imagined. Today's word processors do a lot more than just edit text; they have evolved into multifaceted operating environments in their own right.

Sure, developers have concentrated on designing applications that help us edit and lay out text faster and (hopefully) better, but they're also starting to build in the flexibility we need to customize the software so it works the way we do.

By picking and choosing among a variety of add-ons, you can create a word processing and document creation system that is far more tailored than anything you can find in a single box. There are programs that specialize in checking spelling and grammar, finding the right word, translating documents into different languages, and even faxing from your desktop.

Today, virtually every word processor has the tools to help clean up your writing. Not too long ago, though, the software did just two things: edit and format text. Developers soon discovered features that they or third-party vendors could add on. The spell-checker was the first writer's tool to go this route and become enormously popular—first as a standalone program and then as an integrated component.

We wanted more. Once we discovered the enormous benefits of the built-in spell-checker, the built-in thesaurus appeared and was hailed as another step in the road to good, clean writing. More recently, developers introduced us to the grammar checker.



If you want your word processor to play a more active role in your writing, try feeding it some add-ons.

FACT AND FICTION

The English language throws curve balls that dupe all of us at one time or another. Developers keep trying, but the battle against our language's grammatical eccentricities continues. Grammar checkers are already part of at least four word processors: Microsoft Word for Windows, Lotus Development Corp.'s Ami Pro, Symantec Corp.'s JustWrite, and Software Publishing Corp.'s Professional Write Plus.

Still, there's a market for add-on grammar checkers. In part, it's because WordPerfect does not yet have an integrated grammar checker. In part, it's because the add-on packages still offer features not found in the integrated grammar checkers. In part, it's because I've yet to see any grammar checker with the intelligence to do a complete job.

The best-known standalone grammar checkers are Reference Software International's Grammatik 5 (800-872-9933), WordStar International's Correct Grammar (800-523-3520), Que Software's RightWriter (800-992-0244), and Oracle Corp.'s PowerEdit (800-800-4254). All of these programs offer more flexibility in customization than the versions that typically come bundled with word processors.

I particularly like the way you can install most of them so they run from the menus of individual programs as well as from the main Windows system menu. This way, you can check the spelling and grammar in any Windows program, even in your electronic mail.

Someday, all word processors may come with grammar checkers, but enterprising software developers will continue to build on the word processor repertoire.

Still, even a good grammar checker does not replace the need for an on-line dictionary. Your choices range from fairly simple ones that have been on the market for some time—WordScience Corp.'s Instant Definitions (800-869-9673) and WordStar's American Heritage Electronic Dictionary—to the full text of several large dictionaries. Reference Software's Random House Webster's Electronic Dictionary & Thesaurus, College Edition, includes the full text of the printed versions of those books, which totals over 2,000 pages and occupies 10MB of hard disk space. The largest of all is the new CD-ROM version of the Oxford English Dictionary, from Oxford University Press (212-679-7300). It contains the full text of the 20-volume, 616,500-word dictionary; has a powerful search engine that makes it an unparalleled research tool; and at $895 is one-third the price of the printed version.

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PARLEZ-VOUS PCP

Perhaps the most unusual dictionary and thesaurus I've seen is WordStar's Lexica, a translating dictionary that knows English, Spanish, French, German, and Dutch. It won't exactly translate your document for you, but its ability to translate words and phrases can certainly make the translation process easier.

Other add-ons let you translate information between multiple formats: Software Bridge, from Software Compatibility Corp. (800-333-1395), and Word for Word Professional, from Mastersoft (602-277-0900). Of course, all the major word processors have format-translation features, but they aren't as complete or as accurate as you might like. Another choice is Software Compatibility's Outside/In, which lets you copy and paste data from more than 90 file formats into your documents.

You can customize your system even further. Some packages are not specifically for word processors, but you can integrate them easily. Most of the popular fax software, many OCR packages, and even some personal information managers synergize well with word processors. Packages like Ami Pro even let you create menu-bar icons for Lotus's cc:Mail, Notes, 1-2-3, and Freelance Graphics.

Given this level of software integration, it won't be long before we expect every word processor not only to help us edit and layout text, but also to find the right words and the right information from any source we choose. □

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Bill Machrone

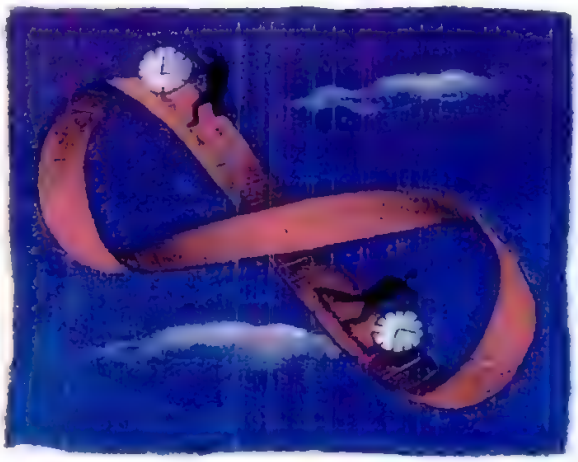
Lies, Damned Lies, and Benchmarks

Computers are commodities, or so the story goes. Applications rule. Therefore, you should buy the machine that is fastest at running your application. It sounds logical. But the rhetoric that surrounds benchmark testing has split the advocates into two camps: those who espouse "real-world" benchmark tests, and those who champion "synthetic" benchmarks.

Common sense tells us that real-world benchmarks are superior to synthetic benchmarks. Remember, though, that there's nothing particularly real-world about using a stopwatch and running a set of instructions that may or may not match what you do with an application. It's not a real-world benchmark; it's an application benchmark.

Synthetic benchmarks, on the other hand, have a name that *sounds* suspicious. Like Frankenstein. Synthetic benchmarks aren't synthetic at all; they're real tests of isolated components. Just as swimming exercises your entire body and weight lifting isolates specific muscle groups, benchmarks exercise the computer in different ways. So let us dispense with benchmark bigotry and talk in terms of application benchmarks and component benchmarks.

Every application works through a multiplicity of layers to get to the hardware and perform the desired result. Think of the application layer as "what" the computer is doing, and the operating system and drivers as "how" the computer does it. The hardware itself is the "why," since the silicon and the circuitry are relatively immutable. Thus, the application is heavily dependent on a host of other things being done right. The user in search of ultimate performance chooses the fastest application, the fastest operating environment, the fastest drivers, and the fastest hardware.



There are in fact two things, science and opinion; the former begets knowledge, the latter ignorance.—Hippocrates

HOW'S YOUR VISION?

Anyone who claims that computers are indistinguishable from one another needs glasses. Cars have four wheels, consume fuel, and get us down the road, but we buy the car that suits our needs and lifestyles. If we have trouble distinguishing one from another, we ask the advice of someone more knowledgeable.

Likewise, superficially identical computers vary widely in their performance. The processor runs at its designed clock speed, but how many of those CPU cycles you actually get to use makes the difference between a fast machine and a slow one. The differences are dramatic. The most popular way to boost efficiency is with cache memory, which holds a small portion of main memory contents in very fast memory chips that the processor can access without wait states. The actual hit rate of caches can vary from at least 70 percent to less than 10 percent. When data is not in the cache (a miss), it's loaded from main memory with more than the usual wait-state penalties. Thus, a slow cache can hurt system performance.

Disks and disk controllers vary widely in their ability to move data to and from the processor. Manufacturers mask the differences with a disk cache. Disk performance is a complex set of interactions among seek times, data rates, the cache size, and the bus width. The ground rules continue to change: Microsoft Windows 3.1 increases its performance by bypassing DOS and going directly to the controller. This limits compatibility with some high-perfor-

Illustration by Whitney Sherman

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PC Magazine has called PrintDirector a "device we can unreservedly recommend to direct the printer sharing needs of almost any user."

And for good reason. PrintDirector offers world-class peripheral sharing products for every budget and work group. Including PrintDirector Bronze, the most affordable printer sharing device. And PrintDirector Gold Turbo, the world's fastest. (Plus PrintDirector Silver, the world's next fastest.) Test results prove it.

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Harvard Graphics Output File (Seconds to Print)	PrintDirector Gold Turbo	PrintDirector Silver	Novell Lite	ASP	ESI	Buffalo	Lantastic
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*PrintDirector Gold Turbo printed nearly five times faster than Novell Lite, almost 2 1/2 times faster than ASP Port Authority, about twice as fast as ESI Share Spool and Buffalo SLmkII, and 40% faster than Lantastic. *Based on printing an output file created with Harvard Graphics. Total time for three PCs to print concurrently to two printers.*

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mance controllers, but in most cases it helps dramatically.

Video performance also varies widely. Starting with the raw performance potential of the chosen VGA chip, it's all downhill as the video memory organization, bus interface, VGA driver, and application itself get in the way of fast screen draws and refreshes. The current VGA generation does more in hardware, shifting some of the load from the driver. The next step will be local-bus implementations of these chips, with 32-bit interfaces to the processor bus.

DON'T TRY THIS AT HOME

Application programs are the unwitting victims of all these complexities. Executing an application benchmark tells you one thing: that application's speed on that machine with that configuration. A simple change to your CONFIG.SYS or AUTOEXEC.BAT file can make a dramatic difference in performance. Since application benchmarks normally use the application's macro language, they are dependent also on the skill of the writer.

Application benchmarks have another annoying problem: You can't distribute them, and you obviously can't guarantee that all PCs have the same configuration. So don't try this at home, kids.

We're still left with the critical question: Which one *is* faster? It takes a real effort to understand all the subtleties and interactions among system components, but only component benchmarks isolate the performance of components to the extent that the buyer or systems integrator can make informed decisions.

There is a demilitarized zone between application and component benchmarks: profiling. Power, intermediate, and beginning users all have different profiles. A monitoring program records the operations of users doing everyday functions. Then you build component benchmarks to match the profiles. This is unbelievably complex, but we're doing it at PC Magazine Labs and ZD Labs. We're also correlating between application benchmarks and our component benchmarks.

There are no easy answers in performance testing, only difficult questions. □

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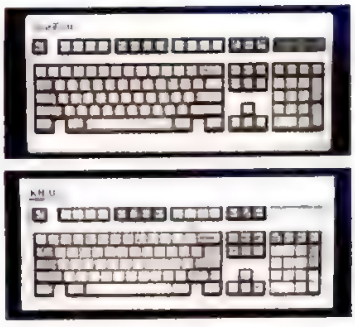

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A futuristic fantasy? Not unless the future is now. It's the ZEOS Pocket PC, and only ZEOS has it! You're going to love how portable and affordable it is. In fact, we think you'll find it's the one PC you'll want to take with you everywhere!

COMPACT YET COMPLETE. 1.3 lbs!

At only 9⅝" x 4½" and only 1.3 lbs., what's great about the ZEOS Pocket PC is that it has a keyboard you can really use. If you're accustomed to typing with both hands, switching to a palmtop PC can be awkward because the keyboard only lets you type with one hand or even one finger. Yet the ZEOS Pocket PC's keyboard lets you use both hands easily, so you won't sacrifice comfort and speed for portability.

And even though it's small, the ZEOS Pocket PC carries a *full suite of industry standard software* already loaded and ready to go! You get *Microsoft DOS 5.0* system files with built-in file transfer and *Microsoft Works 2.0* with word processing, spreadsheet, database and communications programs. Plus, you get a personal organizer which includes a calendar/planner, "to do" list, business card file, information retrieval (for country codes, converting measurements and currency) and more. It's everything you need to manage your life!

IT JUST KEEPS GOING . . .

Ten hours of continuous use? Absolutely! All it takes is the two AA alkaline batteries included with your system. And your ZEOS Pocket PC has great power management, too—it automatically switches to the suspend mode when you take a break. Plus, when you turn off your system, then turn it on again, it goes right back to where you left off. What a time-saver!

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PC Magazine, in their recent Service and Reliability issue said, "Only ZEOS portable PCs achieved significantly higher-than-average ratings in all four categories." The four categories were *reliability, future purchase plans, repair service satisfaction* and *technical support*. And remember, ZEOS technical support is 24 hours a day, 365 days a year, and always toll-free. And we back every ZEOS purchase with our 30-Day Absolute Satisfaction Money-Back Guarantee, One Year Limited Warranty and more.

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ZEOS

John C. Dvorak

The Demo Dilemma

I was about to excoriate Westbrook Technologies for shipping me boxes of air when I determined that the review copy of its Imagic image management software was a "demo pak." Inside the large box were a couple of disks and a small booklet.

I may as well tell Westbrook and everyone else out there that I don't do demos, and I wish other columnists and writers wouldn't pay attention to them either. It's just too easy to be bamboozled, especially with something as complex as software.

Most established columnists and reviewers of computer products receive hundreds of unsolicited packages from review-hungry software companies. Since software is inexpensive to manufacture, there is little reluctance (except by incredible rubes who sometimes ask the reviewer to *buy* the software) to send a copy to the hundred or so influence peddlers in hopes of getting a favorable mention somewhere. It's a long shot, but the potential payoff can be big if, say, software junkie and *PC Magazine* editor-in-chief Michael J. Miller falls all over himself praising some new package, or if I post it in Inside Track under Genuinely Interesting Software.

But what should the reader know about the methodology behind this kind of evaluation? The reader should know that no two people review products the same way. My advice is always to get a second opinion, especially if the decision involves spending lots of money.

The problem stems from demos. I know the columnists at *PC Magazine* never hand out reviews based on demos (or worse, mere press releases), but this is not the case everywhere.

There are three kinds of demos. One is the self-running demo disk that shows the program's features along with a promotional sales pitch. The second is a crippled version of the program that almost works. From this, you're supposed to form an opinion. The third—and most dangerous—is the "live" demo where some geek from the company comes into your office and walks you through the program while showing off all the whiz-bang features. This is dangerous because if the person doing the demo is good enough, he or she will have you convinced that this is not only a wonderful product but easy to use. In fact, you'll think you can use it just by watching the demo. Unfortunately, this is never the case.

Some years ago I learned this lesson the hard way by allowing myself to be suckered into watching such a demo, only to discover that when I tried to use the program, the software was completely unusable. Nothing made any sense except to the programmer, who also did the demo.

So what good are demos anyway? I personally find them to be completely useless.

The self-running demo disk and the crippled version are both decent sales tools. You can play with the software to see if it's worth buying, but the demo doesn't tell you much more. While the crippled program is more useful for determining usability, you're never sure whether it will crash at the same point or if incompatibilities are lurking in the full version. The self-running demo is really nothing more than an animated brochure.

The "live" demo belongs in one place: at a trade show. It's purely a presentation and nothing more. If I want to see one I'll go to a show.

Don't be bamboozled by a "demo disk." You may think you're seeing the real thing, but it's actually just a sales tool.

Illustration by Whitney Sherman

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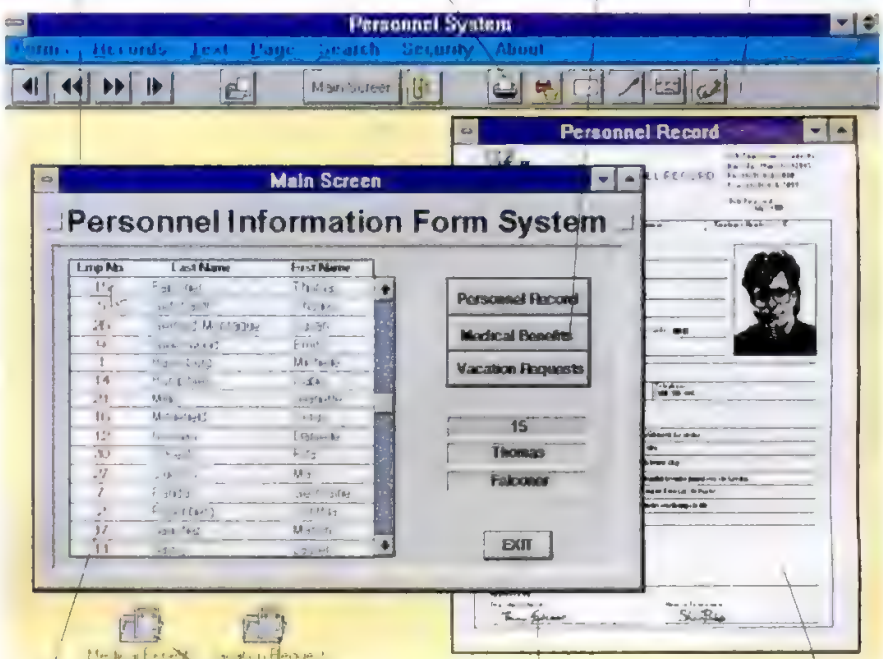

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John C. Dvorak

Inside Track

A Modest Proposal Dept.: In the last couple of weeks I was plowing through a lot of software and noticed some variation in the shrink-wrap. It's obvious that competing plastics are now used to shrink-wrap the software. This gave me an idea that software vendors should heed: **coded shrink-wrap.** There's no reason shrink-wrap can't be preprinted, holographed, laserized, or coded somehow to ensure that the software is original and not rewrapped by the store.

This idea fights both **counterfeiting** and the re-shrink-wrap technique employed by retail stores that want to recycle returned software at the expense of the second buyer, who then becomes a **target for a virus.** Now, having made this suggestion, I'll be even less tolerant of the **whining software companies** preoccupied with **bootleggers** unless they take some anti-counterfeiting action.

Look for Microsoft to begin shipping a ROM-based version of Windows for notebooks and palmtops. Its rumored desire is to find a way to put Windows on microwave ovens and VCRs.

Color Laptop Dept.: I took a good look at the heavily publicized Toshiba T4400SXC. Toshiba people tell me that so-called yields on the much-desired active-matrix color screens are improving rapidly and that prices will slowly drop over the next few years. Just over a year ago, **less than 8 out of 100 screens would work.** That number has jumped to 40. This is obviously good news.

I was impressed by the quality of the T4400SXC and so I decided to put the machine to **the ultimate test:** to find out if it runs OS/2. The T4400SXC comes with 4MB, and I added an 8MB RAM card to bring it up to 12MB. Then I handed it to my 15-year-old and told *him* to install OS/2. He did it in 44 minutes flat, declaring it **a world's record** (kids!). It works like a champ even mouseless, and now I have a color laptop OS/2 machine. This is **a lesson** for those who can't seem to install OS/2 at all. Very nice machine. Highly recommended.

The big discovery I made was that Toshiba add-in memory can easily be **beaten in price** by third-party vendors. New Media Corp.—one of the new breed of companies specializing in PCMCIA cards and variations (including the peculiar Toshiba memory card)—can deliver **memory at half the price** of Toshiba. The company has similar memory cards for the Compaq machines, as well as other odd laptop makers who hoped to keep memory proprietary and make a few extra bucks. My recommendation to all: **Stay with the PCMCIA specification** and forget about these odd one-of-a-kind specifications. I'm using the New Media 8MB card in the T4400SXC. Works great. For prices contact New Media, 15375 Barranca Pkwy., B-101, Irvine, CA 97218; 714-453-0100; fax, 714-453-0114. Hot stuff.

Genuinely Interesting Hardware Dept.: How can anyone resist a product like the **Corvette Mouse?** Actually, it's a little model Corvette that fits over a Macintosh or Microsoft Mouse. The user presses on the hood of the 'Vette to activate the mouse button underneath. The company says, "Instead of having a boring-looking mouse on your desk, you're driving a hot Corvette!" **Cheap thrills** at only $19.95. To order one of these nifty covers, contact Suntime, 7817 N. Cameron Ave., Tampa, FL 33614; 813-886-1145. Very cool.

Wacky News of the Moment Awards: The first prize goes to **Cray Research** for developing a C++ for use on Cray supercomputers. The company says that object-oriented software development is headed toward supercomputers. I'm glad to see that **bloated code** is now universal.

Worried about those pesky FCC rules concerning RF radiation? Call the Government Printing Office at 202-783-3238 for copies of the ***Interference Handbook,*** which outlines methods for eliminating radio-frequency interference. Be ready with your credit card number and the publication stock number: 004-000-00482-5. It's 2 bucks (cheap!).

Last Tidbit Dept.: Look for Microsoft to begin shipping a ROM-based version of Windows 3.1 so the company can help vendors put **Windows 3.1 on notebook and even palmtop machines.** Even more interesting is the rumored desire of Microsoft to find a way to put **Windows on home appliances** such as microwave ovens and VCRs. You have to wonder about some of this. There will be Windows chips, fuzzy-logic chips, and neural network chips all geared up to run washing machines and microwave ovens. Are any of these designers aware of a simple on/off switch as an **inexpensive substitute** for all this nonsense? □

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The trouble with computer networks is they come in so many different species, which, as you may know, don't always get along. Conflicts between networks can turn your business into a real zoo.

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Jim Seymour

The New PC Marketplace

This summer saw the beginnings of a brutal upheaval in the PC business. The steep downward move of PC prices was accelerated by Compaq's deep price cuts in June, which led to similar cuts by other manfacturers.

One consequence of this market restructuring is that a number of second- and third-tier PC vendors, already barely surviving on razor-thin margins or even operating at a loss, have been or soon will be squeezed out of business.

We should acknowledge that this kind of market upheaval was both inevitable and, in the end, economically desirable. The PC-clone business has, since about 1983, been a classic easy-entry business. It hasn't taken much capital, technical knowledge, or business savvy to jump in. And because during that decade PC sales have been booming, many companies that in fact had few business and technical resources survived. Some even prospered.

Now, with technical and business skills as well as financial strength so important, those marginal vendors are fading fast. This trend, economists would remind us, has beneficial effects. Efficient markets weed out the marginal competitors—the vendors who, because of their perennially insecure positions, are inclined to cut corners on quality or engage in suicidal pricing. With these "noise" vendors gone, the surviving companies are stronger, more secure, and better able to fund the R & D and quality-control steps that lead to new technologies and better products.

And, cynics will add, the reduced competition will make it easier for PC vendors to jack up prices—maybe even slow down the pace of technical advances so as to reduce costs further and milk their present lines as cash cows.

Today's restructured PC industry may force some vendors out of the business. That's not necessarily bad.

I'm not much worried about an end to competitive forces in the PC market and a resulting sag in progress. Anyone who thinks the PC marketplace is now mature is out of touch; this remains a fantastically chaotic and vigorous market. And PC vendors continue to spend fortunes to trump one another on performance.

Moreover, much of the technical advance of the PC business is driven by the chip makers. Indeed, the rapid evolution from 386s to 486s—and the anticipated arrival of the whatever-they-call-them 586s and 686s very soon—was one of the forces driving prices down over summer.

I think the PC business as a whole is a lot healthier today than it was a year ago, and I think that by this time next year, it will be a lot stronger still. It just won't *look* the same.

It's also important to note that while this is a tough time to be a maker of personal computers, it's a great time to be in the PC software business.

I was talking recently with a longtime corporate client. He used to say, back in the mid-eighties, that he didn't mind software piracy in his company, because the less software he had to buy, the more hardware he could buy on the same budget. Stealing from the software vendors in order to buy more hardware, he called it.

Now he's singing a different tune. With plummeting PC prices, he says he feels like he's stealing from the hardware vendors to buy more software. "And at the right time, too," he

Illustration by Whitney Sherman

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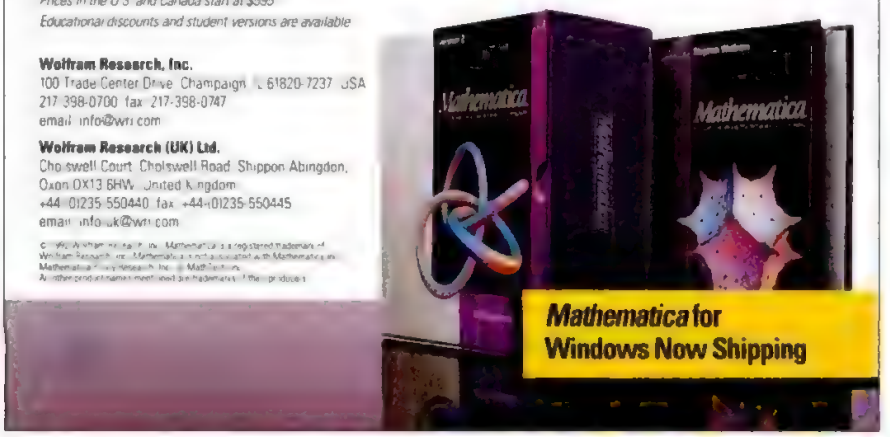

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Jim Seymour

continues, "because with the change to Windows, we're buying a *lot* of software."

Exactly.

The migration from DOS to Windows is a once-in-a-decade opportunity for software publishers to overturn the market leaders and to restructure the software business almost overnight.

The time to make a killing in the software business—some would say the only time—is when there's a fundamental paradigm shift. We saw that phenomenon in the move away from Apple II software with the advent of PCs and MS-DOS; we're seeing it again with the move to Windows. I don't think software companies will see this big an opportunity again in this century.

Don't be fooled by reports of reduced operating margins, and even quarterly losses, at the major software companies. Those sags in earnings arise from today's desperate race for market share in the Windows era. The real money in PC software comes from "versioning"—selling succeeding versions of a product to your installed base. Software houses are consciously forsaking today's profits to position themselves for the rich pastures of a stabilized Windows software market.

And some companies are still doing *very* well. Microsoft, for example, posted a 52 percent increase in net income for the second calendar quarter of 1992—50 percent higher than its historical growth.

At Compaq, net income for the second quarter was up 43 percent. Falling prices forced Compaq to reposition itself and to address market sectors it had ignored; its less efficient competitors' problems helped, too.

As buyers, we benefit directly from lower hardware prices, and also from the intense competition among software publishers, which produces both better products and lower prices.

The next time people moan about the PC business going down the drain, ask who's going down which drain. And whether the problems of less efficient, less well capitalized and managed companies really reflect the state of the PC industry as a whole. □

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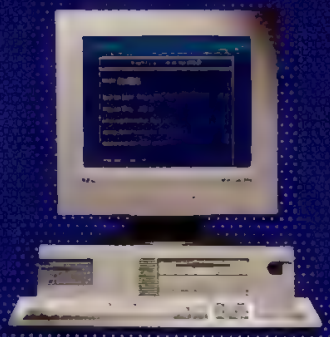

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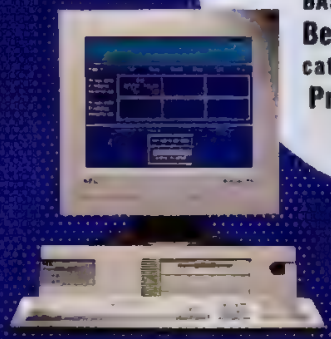

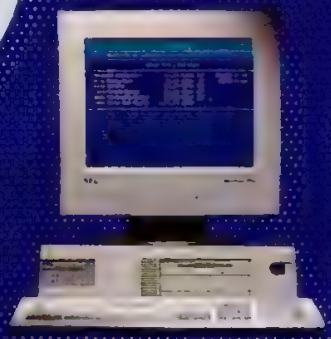

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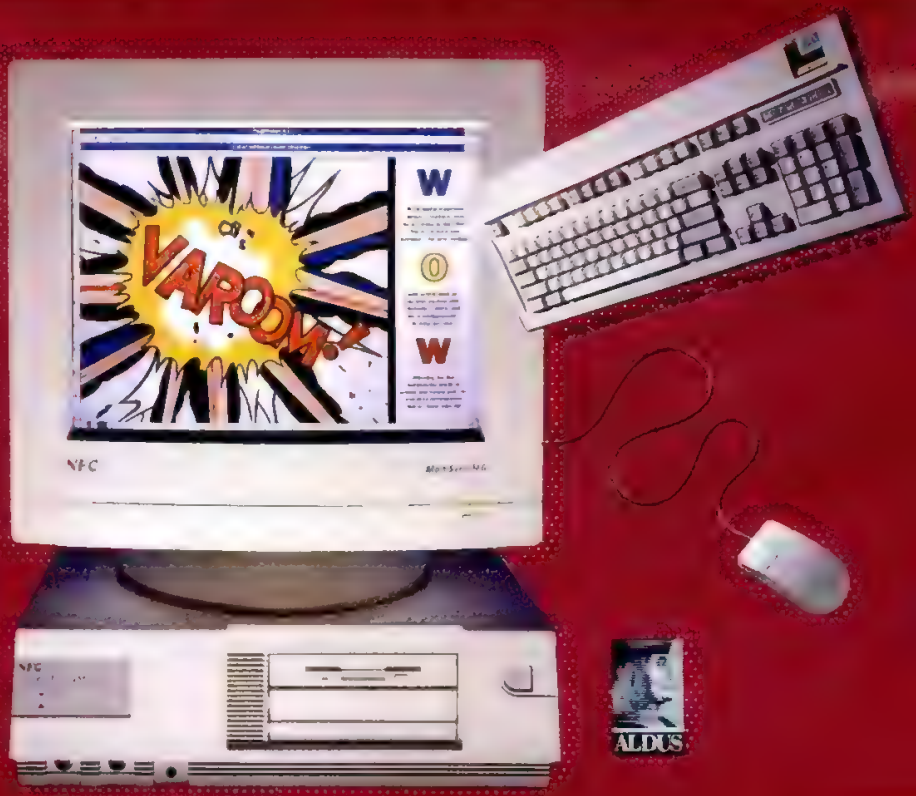

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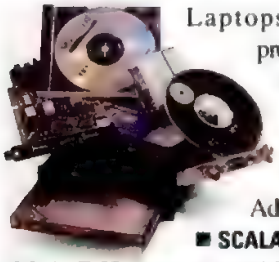

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William F. Zachmann

Need Information? Get On-line!

Help! I'm drowning in a sea of information! The worst thing about the age of information is that there is so much of it. Just keeping up with electronic mail and bulletin boards is getting to be a full-time job. Still, it's worth the trouble.

I admit I'm not typical of the average personal computer user. I suspect, however, that this electronic information inundation will spread to a growing number of personal computer users in the near future, for good reason.

Let's examine my situation. I have three different MCI Mail accounts. I regularly monitor all the messages on more than a dozen CompuServe and Ziff-Net forums. Some have scroll rates that run between 500 and 1,000 messages daily.

I also have a Prodigy account, and I periodically check in on more than a dozen specialty BBSs. I am repeatedly urged to get onto Internet and several other networks as well.

I spend at least 4 or 5 hours a day (including weekends) reading and responding to electronic messages. It's become almost routine for me to wake up at least once during the night to log on. I talk to people all over the world in the process.

You may diagnose me as a pathological and isolated case: a hopelessly addicted electronic information junkie. There is, however, evidence that I am not alone.

Others in "cyberspace" are doing exactly what I'm doing. There wouldn't be so much information out there if people like me weren't there to generate it.

Our numbers are large and growing steadily. Doctors, lawyers, students, programmers, executives, stamp collectors, consultants, musicians, and who knows what other folks routinely log on to hundreds of networks, bulletin boards, and e-mail services. More and more are doing so every day.

We are the future. By the year 2,000, these services will be as common for most people in the civilized world as phones and television. Even schoolchildren will log on to BBSs to talk or play games.

We are not wasting our time, either. Sure, there may be a few truly pathological on-line information junkies who indulge their addiction for its own sake, like hard-core hackers who program only to program. Most, however, do what they do for a purpose.

I use the on-line info to monitor trends in the industry; it's part of my job as a consultant. When I worked at a large market research firm, I would walk down the hall and talk with colleagues who monitored different technologies and products. Now that I run my own business, I log on and see for myself.

This strategy is good for anyone who evaluates, selects, or deploys PC software and hardware. There is no more immediate way to learn about what's going on in the industry.

While off-line America sleeps, info junkies and ordinary folks are talking to each other on-line.

Interested in how a new product is doing? Just log on to a forum or a BBS that covers it. You can find out, almost instantaneously, from real users, if it's a bug-free winner or if it's unstable and a lousy performer.

Need help with a particularly knotty problem? Post a message. You'll usually get first-rate help within hours.

Millions of PC users are already on-line. If you're not, I urge you to get a modem and some comm software. Come join us in cyberspace. □

Illustration by Whitney Sherman

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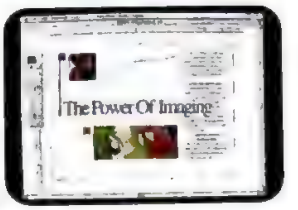

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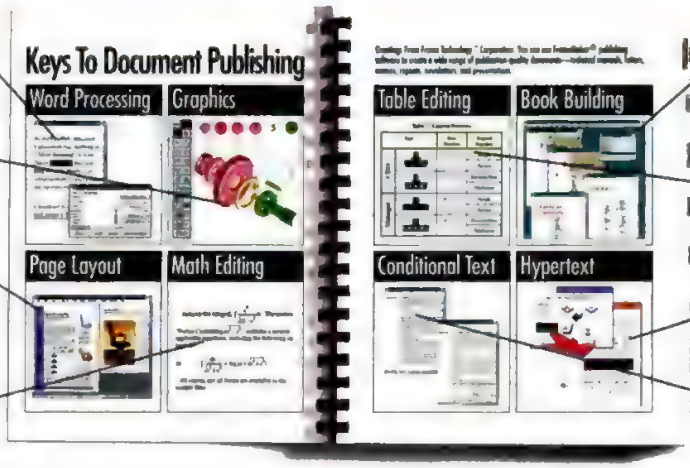

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486SX: The New Entry-Level PC

PCs based on Intel's 486SX conquer the 386's turf with great price/performance ratios and OverDrive potential. PC Labs tests 58 PCs built around the 486SX/25.

Photograph: Enrique Cubillo

by Matthew J. Ross

The people at Intel are serious. They don't want anyone to buy a 386-based desktop computer ever again. Oh, they'll keep selling 386 processors, and the portable PC market will be dominated by 386s for the next year, but Intel is serious about this. It wants your next computer to be a 486, and it wants the next low-cost corporate platform to be 486SX-based. For the company to remain as successful in the coming years as it has in the last four, Intel needs to be the only game in town: the only company offering a 486 (it no longer is), or at least the microprocessor performance leader.

Even so, Intel knows that not everyone needs breakneck performance, and that more microprocessor sales are made at the bottom of the performance curve. After all, price is a factor, too. That's where the 486SX comes into play. For the last couple of years, the 386SX has been Intel's cash cow. By the end of this year, Intel will have sold more than 20 million 386SXs since the chip's introduction back in June 1988. The 386SX was quickly hailed as the corporate standard for desktop computing, the machine on every company's purchase orders. Now, three years later, as Microsoft Windows has grown in popularity (spurring the need for more powerful PCs), and the rate of technology continues to feed our performance-hungry appetites, the bulk of the market has moved past the 386SX.

For Intel, the answer is the 486SX. And it may be for you, too. To help you decide, we look at 58 486SX/25 systems in this issue.

Renewed competition in the microprocessor industry from Advanced Micro Devices (AMD) and newcomer Cyrix has turned the once exclusively Intel PC-compatible CPU market into a confusing battleground for customers who were once solidly Intel's own. AMD's 386, which is faster (40-MHz) and lower-voltage (3.3V as well as 5V), has now been joined by Cyrix's 386SX/486SX hybrid, the Cx486SLC microprocessor. The Cyrix chip doubles the performance of a 20-MHz 386SX, adds a 1K internal cache,

and further confuses the marketplace by using "486" in its name, especially since the shipping SLC version has only a 16-bit data path. (An upcoming DLC version will have a 32-bit data path.)

THE CASE FOR THE 486SX

The stakes are high in the battle for the desktops of corporate America. So what is the case Intel makes for the 486SX?

• **Competitive pricing.** As the power in the microprocessor industry, Intel has the resources to fight the competition from AMD and Cyrix, or even step up the CPU pricing battles. The end result to buyers: fully configured 486SX systems (with 4MB of RAM, a 200MB hard disk, and Super VGA) available for as little as $1,500 each.

• **Upgradability.** The marketing disaster known as the Intel 80487 math coprocessor has been set aside in favor of Intel's OverDrive ("vacancy socket") strategy. Intel's vacancy socket effectively extends the performance life of a PC by two or three years at little cost (about $500) or trouble to the user. And while AMD and Cyrix can boast of strong performance (both their chips have it), and wage price wars with Intel (these have already begun), only Intel's speed-doubling DX2-based OverDrive technology currently offers such an easy upgrade path.

• **Greater performance.** Intel's 25-MHz 486SX outperforms both AMD and Cyrix's current processors in terms of pure processing power on a wide range of benchmark tests.

These three trumps can keep Intel in charge as the dominant microprocessor manufacturer, the one selling its entry-level processor to the bulk of the corporate market. Add in the market forces currently at work in the PC industry—the dramatic price cuts and the recent lower-price "value line" introductions of major players like AST, Compaq, Dell, and Zeos (Occidental) to gain market share—and you have a recipe that means the end of the 386 and even lower prices for 486-based PCs. Given these prices and the upgradability of the 486, we don't see a reason to buy a 386 desktop again.

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HISTORY OF THE 486SX

While Intel has viewed the 486SX as the natural successor to the 386SX since the company introduced the chip last spring (April 1991), the 486SX did not receive the popular reception garnished by its 386 sibling. (For more information, see "486SX: Great for Intel, but What About You?", December 31, 1991). What made the 386SX so popular at its onset was the chip's 16-bit external design. Internally the 386SX is a true 32-bit processor, fully compatible with Intel's 386DXs. But by using a 16-bit external design, Intel made it easy for system manufacturers to design inexpensive yet powerful PCs that could work with the 16-bit memory architectures prevalent at the time.

To the industry, the "SX" in 386SX meant sixteen. In effect, vendors were building 286s that offered the processing power and software compatibility of a 386. To the end-user, though, the "SX" meant a low-cost entry to high performance. Customers could buy these systems for just a couple hundred dollars more than a 286. Intel helped hasten the demise of the 286 with the effective ad campaign that spray-painted an "X" over the numbers "286."

Intel hoped its formula, SX = Low Cost + High Performance, would carry over to its 486 line when it unveiled the 486SX last year. Well, the initial reaction

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to the 486SX was hardly positive. With the disabled FPU circuitry that all the original 486SXs carried inside, last fall's 486SX was bluntly called a crippled 486. And the extended benefits of the then 80487 socket, now called the OverDrive socket, were not clearly detailed at the time by Intel. And fully configured systems cost about $4,000 each. Much of the industry complained, including us here at *PC Magazine,* that here was a chip introduced for marketing rather than performance reasons.

Why was there ever a 486SX? Intel figured that not everyone would need the floating-point math coprocessor built into every 486DX. To get the 486SX chip to market quickly, Intel used existing dies for the 486DX, but Intel disabled the FPU circuitry. Because Intel left the circuitry on early versions of the chip, users felt cheated. (Newer, smaller versions of the 486SX manufactured in plastic do not carry the disabled FPU circuitry.)

Intel made matters worse by creating the 80487 upgrade scheme. The 80487 coprocessor upgrade was for all intents and purposes a 486 that plugged into the vacant chip socket—initially called PUS (processor upgrade socket) and PES (processor or performance enhancement socket)—that Intel wanted each systemboard manufacturer to include (at an added cost). The user therefore had to pay for a second CPU, which relegated the 486SX chip nonfunctional. Given all the contention that surrounded the chip, it was no wonder the 486SX's increased processor performance over that of the 386 chip went relatively unnoticed.

SQUEEZING THE COMPETITION

With the renewed competition in the PC market, prices are falling. Intel has aggressively priced its 486SX chip to cost the same as or little more than its 386 CPUs, which discourages PC manufacturers from selling 386-based systems. As the pricing table on the next page shows, Intel's 486SX/20 chip costs basically the same as a 386/33DX chip. The result to the end user is clear: While 486SX systems now cost $4,000 less than they did just a year ago, the majority of the 58 systems that are reviewed here hover around the $2,500 mark, with companies like Compudyne Products offering com-

PC MAGAZINE

EDITORS' CHOICE

- **Ariel 486SX/25**
- **Lightning Omniflex 486SX25**

Intel trumpets the 25-MHz 486SX processor as the new standard engine for entry-level business computing. Priced virtually the same as a 33-MHz 386 and with better performance, the new 486SX chip promises—via Intel's aggressive marketing campaign for the vacancy (or DX2) upgrade socket—easy OverDrive upgrades for significant performance gains. Most of the 58 486SX-based systems reviewed here have similar components, nearly equivalent performance, and low prices befitting their status as entry-level business PCs. Five entries, however, manage to stand out: the Ariel 486SX/25 and Lightning Omniflex 486SX25, our Editors' Choices; and the ACMA 486SX/25, Compudyne 4SX/25, and Dell System 486D/25, which merit an honorable mention.

The $1,695 (as tested) Lightning Omniflex 486SX25, a standard-width desktop system, is the quintessential entry-level PC. The Lightning Omniflex 486SX25 offers plenty of expansion room, an OverDrive socket, a 128MB RAM capacity, a 64K processor RAM cache, the excellent Quantum ProDrive LPS 240-AT hard disk with its internal 256K buffer, and a speedy ATI Graphics Ultra video adapter. Although it doesn't have the cheapest selling price nor the most outstanding position on our bang-for-the-buck chart, we feel the Lightning presents a superior value when compared with the other PCs reviewed.

At $2,290, the Ariel 486SX/25 was both more expensive than the Lightning and yet competitively priced. Ariel provided extensive documentation and an upgradable processor RAM cache. A highly expandable unit, the Ariel also offered a 64MB RAM capacity, the Quantum ProDrive hard disk, and a Diamond Stealth VRAM accelerator board based around the S3 video chip.

HONORABLE MENTION

An honorable mention goes to the $2,819 Dell System 486D/25. Somewhat more expensive than the average ISA-based systems in this review, it is also one of the best built. This package had the cleanest design we saw. Though it lacks an OverDrive socket, you can perform a fairly simple upgrade with a chip puller.

Another honorable mention goes to the EISA-based ACMA 486SX/25 tower system. Its EISA bus and muscled components drive up its price to $3,894—competitive for an EISA machine but expensive for what most people expect from a 486SX/25.

The $1,499 Compudyne 4SX/25 also gets an honorable mention for an incredibly low price attached to a surprisingly decent system. This is a good choice for those users who are mostly price-driven.

What of Compaq and Gateway 2000, arguably two of the best-known vendors in this review? The Compaq Deskpro 50M won an Editors' Choice in our June 16, 1992, review of Intel 50-MHz 486 DX2s because of its EISA performance, boosted by Compaq's own QVision 1024/E video card, which wasn't included on this ISA system. (You can buy an ISA-based QVison card for $599). In this review, the Compaq Deskpro 486S/25M turned in only adequate performance numbers. Gateway 2000's reputation rests on capably built systems at rock-bottom prices, but in this roundup the Gateway is just another one of the crowd. The Dell was built better, and many other systems with Gateway's quality can be found for less.

petent systems for as low as $1,500.

Intel's aggressive 486 pricing encourages system manufacturers to forgo 386DX systems. And with even lower prices on the way, the 386's future in the desktop market is in jeopardy.

UPGRADABILITY

Intel's pricing certainly makes the microprocessor market interesting. But why should a user opt for a 486SX instead of the Am386/40 if performance and costs are relatively close? As contributing editor Jim Seymour pointed out in our first featured look at this processor class (December 31, 1991), "there is no new standard being created by a '486 instruction set.'" While the 386SX made sense because 286-based systems were unable to run certain software packages, Intel's 486SX does not have the same advantage over 386 systems. So why would you want a 486SX? In a word, upgradability.

Intel wants every PC vendor to include a vacancy or OverDrive socket on its motherboards, or use a zero-insertion-force (ZIF) socket so that every 486 or 486SX can easily be upgraded with Intel's new speed-doubled CPUs. It is making steady headway in this mission, as 29 of the PCs reviewed here offer end-users a quick, relatively inexpensive upgrade path (24 have OverDrive sockets, and 5 have ZIF sockets). Many of the other systems use older, uncached designs as well as some modular PCs whose CPUs reside on upgradable daughtercards. Intel's 80487 coprocessor also fits in the vacancy socket, but the OverDrive chip offers faster integer *and* floating-point processing. The 80487 merely adds floating-point capabilities to your SX without improving the general processing speed.

While the 80487 coprocessor's upgrade value was questioned by many, Intel's OverDrive options offer real choices with significant performance gains (as discussed in "DX2 vs. OverDrive: Do You Want Your Speed Boost Now or Later?" September 15, 1992). Even company representatives at Cyrix praised Intel's ability to develop an upgrade path that is quickly becoming a standard. And Cyrix was quick to point out that even though it currently does not have an OverDrive-type upgrade, motherboard makers can certainly incorporate Cyrix (or AMD) processors on a motherboard with an OverDrive socket, just as vendors have built motherboards that can accept either a 386 or 486 CPU.

Microprocessor Pricing
Unit prices based on 1,000-piece orders (third quarter, 1992)

	Ceramic	Plastic	3.3-volt
AMD Am386/40	$78	—	$78
Intel 386DX:			
16, 20, 25 MHz	$101	$96	—
33 MHz	$122	$116	—
Cyrix Cx486SLC/25	—	$99	—
Intel 486SX:			
16 MHz	$124	$99	$174
20 MHz	$124	$99	$243
25 MHz	$144	$119	$341
Cyrix Cx486DLC:			
25 MHz	—	$99	—
33 MHz	—	$119	—
40 MHz	—	$159	—
Intel 486DX:			
25 MHz	$367	—	—
33 MHz	$367	—	—

HIGHLIGHTS

486SX/25 PCs

INTEL'S 486SX/25 microprocessor clearly outperforms the competitors on PC Magazine Labs' processor test. The Cyrix Cx486SLC/25 runs at 66 and 87 percent the speed of the 486SX/25 in protected mode and real mode, respectively; the AMD Am386/40 performs at 80 and 87 percent; and the Intel 386/33 performs at 66 and 71 percent. The Intel chip continues to drop in price, which means attractive entry-level systems for business desktops.

EXCLUDE the three most costly reviewed systems—the CORE, i Corp, and IBM PCs—and the fully configured 486SX PCs you can choose from have reasonable prices. They come with 4MB of RAM, a 200MB hard disk, and Super VGA; they carry an average price of just under $2,500. The cheapest are as little as $1,500.

THE "VACANCY SOCKET" and zero-insertion-force (ZIF) sockets for Intel's excellent OverDrive end-user upgrade are the attention-getters in this field of 58 486SX/25s. One out of two systems we tested here offer end-users one of these simple methods to upgrade from SX to speed-doubled 50-MHz OverDrive power: 24 systems have OverDrive sockets and 5 more feature the ZIF socket.

Still, not every system has the internal vacancy that Intel describes in its ads, and too many systems (16) had no secondary cache, a must for maximum OverDrive performance. But the trend toward built-in OverDrive upgradability is clear, since this eliminates the need to pull your original CPU when you upgrade.

VIDEO STARS in this field of 486SX/25s used the ATI Graphics Ultra. It produced Graphics Winmark scores of 7 million and higher. Systems featuring this board include the ACMA 486SX/25, Ergo Moby Brick 486SX, Gateway 2000 25MHz/486SX, and Lightning Omniflex 486SX25.

P5 READY? The ME 486SX/Local Bus/25 displayed some outstanding (and inconsistent) results, including a proprietary local-bus video arrangement that squeezed a Graphics Winmark score of 6.38 million from the Tseng ET4000 chip set, which is generally a Windows underachiever. And what's more, this PC's motherboard features a 240-pin ZIF socket; this could be in preparation for Intel's next-generation microprocessor.

WESTERN DIGITAL'S WD90C30 and WD90C31 video chip sets proved to be the best choice for users who need graphics speed in both Windows and DOS applications. While S3 chip–based video is optimized for Windows, and Tseng ET4000 solutions fare better under DOS, the WD chip sets found inside the ALR, Compudyne, Computer Sales Professional, Dell, Softworks, and Tandy PCs handle both environments well.

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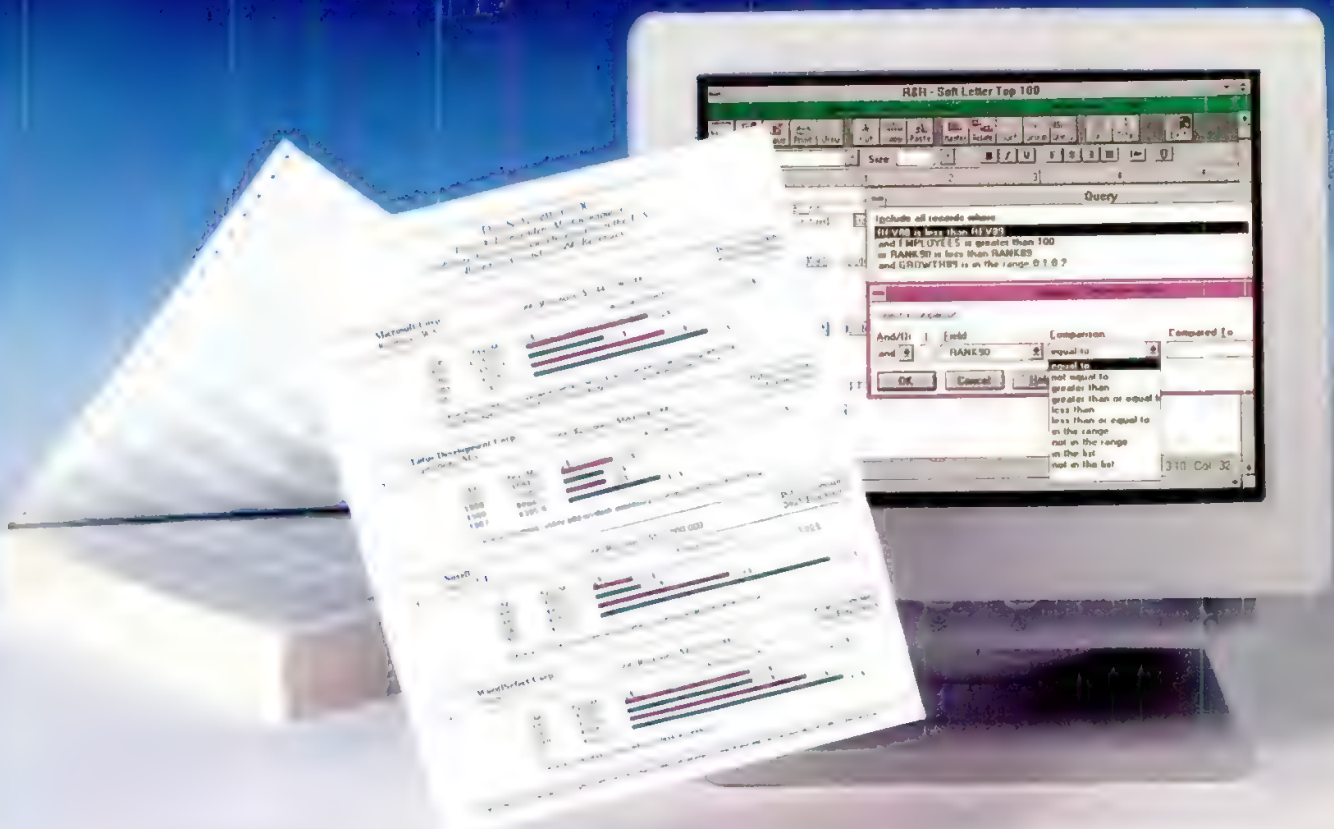

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Price/Performance Index: *25-MHz 486SX PCs*

These 58 486SX/25 machines performed in a fairly tight pack, and most are worth their price tags. Unfortunately, the best-looking systems (those in the top-right area) all suffer from shortcomings.

At $1,866 in our tesed configuration, the Micro Express ME 486SX/Local Bus/25 achieves an optimal price-performance rating. But our review system suffered from design flaws and hardware failures. A similar performer, the Silicon Valley I486SX25-212, was boosted by a caching disk controller; unfortunately, it lacks an OverDrive socket and processor RAM cache. Axik Computer's Ace Cache 486SX-25 delivered good performance, but it has a much higher price and uses proprietary local-bus video (which may be a disadvantage if the VESA local-bus standard catches on). Diamond Technologies' DT-486SX-25 also performed well, but it suffered from some design compromises.

A more complete package is available from Lightning Computers—the $1,695 Lightning Omniflex 486SX25, an Editors' Choice (along with the more costy Ariel 486SX/25). Lightning combines robust components, such as the Quantum ProDrive LPS 240-AT hard disk and the ATI Graphics Ultra GUI accelerator, with a two-year warranty. Though this PC falls short of the above-mentioned systems in terms of performance, it beats them all on price. The Dell System 486D/25 and NEC PowerMate 486SX/25i are both higher-priced, though they were made with excellent attention to detail. Unfortunately, Dell omitted an OverDrive socket, and the NEC's price is high.

The most expensive systems—those from Arche, Compaq, Ergo, Everex, and Tangent—weren't among the performance leaders. One exception was the ACMA 486SX/25. Though its $3,894 price isn't competitive with the ISA-based systems here, it certainly sets a standard for EISA-based PCs.

THE DATA POINTS

The performance/features axis that you see on the Bang for the Buck chart is based on 11 different data points: the five PC Magazine Labs benchmark test scores, installed RAM, disk capacity, VGA RAM, free slots, drive bays, and extras (such as free bundled software, a mouse, on-site service, FCC Class B certification, an extended warranty policy, a 16550 UART, flash memory, and the availability of a 2.88MB floppy disk drive). We have weighted the raw numbers; performance and features each make up half of the total score. You can find this data located in the Software Library of PC MagNet's Editorial Forum. It is located in a file named 17BANG WK1.

The tested-configuration price (as listed in the fact file) determines each system's location on the *y*-axis. We applied a 15 percent discount to the list prices of dealer-distributed systems to approximate street prices, so these prices will differ from those listed in our fact files.

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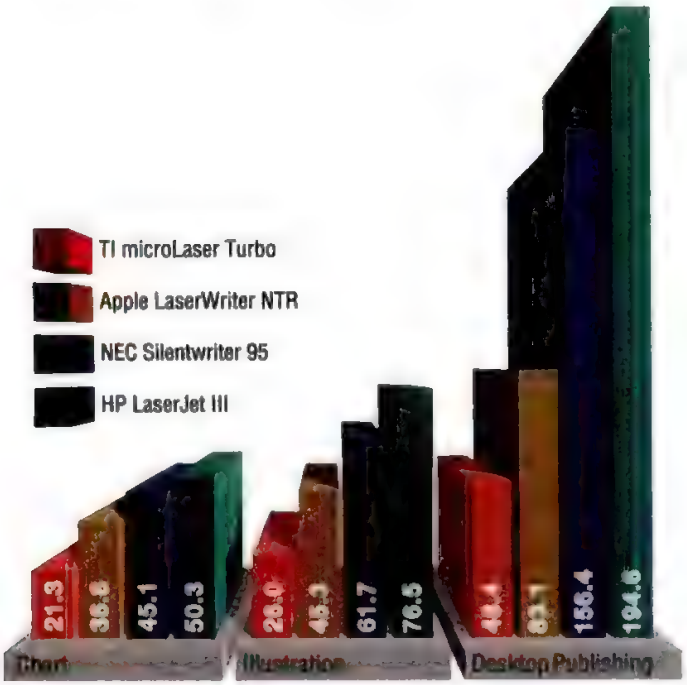

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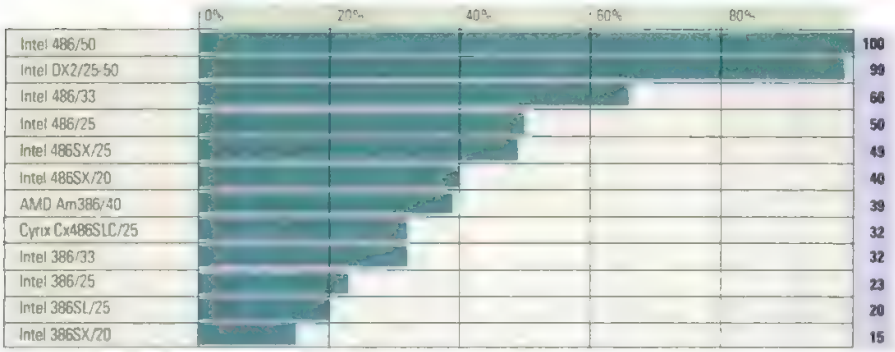
Relative Processor Performance (Protected-Mode Instruction Mix)



And with the increased competition in the microprocessor market, AMD and Cyrix could follow Intel's lead, producing chips that are pin- and logic-compatible with Intel's OverDrive socket.

PERFORMANCE

How well does the 486SX perform? And what about AMD and Cyrix? To find out, we used our new 16-bit real-mode and protected-mode Instruction Mix module, which is part of our processor test suite. The new version, which debuts in the upcoming release of PC Magazine Labs' Hardware Performance Tests, Version 7.0, is designed to fit inside an on-board CPU cache and to minimize CPU-to-memory interaction. Both the Cyrix Cx486SLC/25 and AMD Am386/40 performed the real mode Instruction Mix at 87 percent the speed of the Intel 486SX/25. In protected mode, the Cyrix and AMD ran at 66 and 80 percent, respectively, of the 486SX/25. The table above compares protected-mode CPU performance relative to Intel's 486DX/50.

REVIEW CRITERIA

To be included in this roundup of 25-MHz 486SXs, each manufacturer had to submit a shipping system that included at least 4MB of RAM; a 200MB hard disk; and Super VGA, including Microsoft Windows 3.1 drivers for 800-by-600 with 256 simultaneous colors. Among 486SX/25 systems we did not review, the Destiny Computers entry failed during hands-on testing in PC Labs, and Destiny couldn't get us a replacement in time for our testing deadline. Advanced Interlink and Epson America wanted to participate but were unable to meet our testing deadline. Austin Computer Systems and United Micro are presently considering whether they will continue to offer a PC in this processor class, and therefore they chose not to participate. Expo Tech announced a 486SX/25 system that shipped after our review deadline.

TRENDS

In all, we tested 58 25-MHz 486SXs. Apart from the Micro Channel machines from CORE International, IBM Corp., and NCR Corp., 9 systems were EISA-based, and 46 used the industry-standard IBM-AT bus architecture. We saw the greatest variance among disk technologies, as 47 systems featured IDE hard disks, 2 systems used ESDI, and 9 were SCSI systems (5 of these 9 used the SCSI-2 implementation). Eighteen systems had cached hard disk controllers, including 4 of the 5 SCSI-2 systems.

As we have seen in the past, some of the really hot (and really expensive) cached disk controllers score particularly well on our disk test. It makes sense to put these disk subsystems inside your network server, but more in-depth testing at PC Labs has shown that for stand-alone users and networked PCs, a good software cache performs just as well for hundreds of dollars less.

The changes in video technology reflect the industry's growing move toward Microsoft Windows. Of the system manufacturers featured in this roundup, 43 bundle Windows 3.1 with their PCs, and 22 of the 58 units feature a video adapter accelerated for graphical environments such as Windows (17 of which featured S3's 86C911 video chip set), 4 used ATI Mach 8 chips, as well as IBM's XGA. One coprocessed video adapter appeared as well inside the i Corp Blazer IIs: the Number 9 GXi Lite 20, featuring Texas Instrument's TMS34020 graphics coprocessor. Micro Express incorporated the popular Tseng ET4000 chip set in a proprietary local-bus scheme to achieve a strong Graphics Winmark score of 6.38 million, exceeding the 4.13 million average score of the 58 tested systems. The best video graphics performer was the Ergo Moby Brick 486SX, with its Winmark score of 7.62 million. This PC and the Gateway 2000 25MHz/486SX (7.4 million) owe their impressive Winmark scores to the ATI Graphics Ultra card. And Axik's Ace Cache 486SX-25 scored 7.53 million, thanks to its S3 chip–based Diamond Stealth VRAM adapter.

The most important feature impacting your buying decisions is the presence of secondary caches and either an OverDrive or a ZIF socket. For you to get the maximum performance, both now and in the upgradable future, an external processor RAM cache is a must. Unfortunately, 16 systems tested by PC Labs had no cache other than the 8K cache internal to all Intel 486s. And 14 other systems provided 64K caches, 7 had caches of 128K, and the remaining 21 systems featured 256K of SRAM cache. For these systems, *PC Magazine* recommends a processor cache with at least 128K of SRAM, and we've found that set-associa-

486SX/20 PCs: Recent Reviews

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Ergo Moby Brick 486SX-20	212
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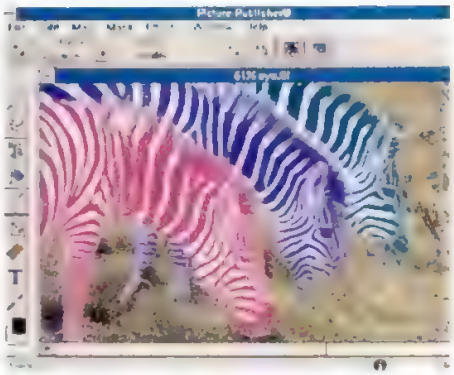

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LOGITECH

tive cache architectures are generally better performers than direct-mapped caches. Caching will improve processor performance as much as 15 percent, but the need for a cache becomes critical if you plan to add the OverDrive chip to your system.

At 25-MHz, Intel's 486SX offers enough of a performance increase over the 386/33, Cyrix's Cx486SLC/25, and AMD's Am386/40. And with its combination of low cost to the buyer and a viable upgrade path inside many of these systems, an OverDrive-ready 486SX/25 is an attractive system.

Intel is serious about the 486SX. If you're looking for a low-cost, midrange-performance desktop for your business, you should be, too.

ACMA Computers Inc.

ACMA 486SX/25

The $3,894 ACMA 486SX/25 goes for a high-powered, high-quality image—and succeeds. This EISA system's well-known brand-name components performed well on our benchmark tests, and for what you're buying, its price is fairly reasonable.

The full-size tower case contains plenty of room for expansion, with four front-accessible 5.25-inch half-height drive bays and four internal. There's a 250-watt power supply and a complete array of front-mounted switches.

On the motherboard front, you'll find Helm Engineering as the manufacturer and Award's system BIOS. A socket for a math coprocessor or an OverDrive chip neighbors the Intel 25-MHz 486, but a Weitek socket is unavailable. A minimum RAM configuration of 2MB can be upgraded to 128MB and is backed by a 256K secondary SRAM cache. ACMA Computers provides eight EISA expansion slots but fills three of them with a SCSI-2 DTC hard disk controller for the 245MB Quantum ProDrive LPS-240S hard disk, an ATI Graphics Ultra coprocessed video adapter, and a typical I/O adapter. Rounding out this package is an excellent ergonomic 15-inch NEC MultiSync 4FG monitor that can handle 1,024-by-768 resolution at entirely VESA-compliant vertical refresh rates, DOS 5.0, and Windows 3.1.

Performance was extremely competitive, as it should be with these components and this kind of price tag. The secondary 256K SRAM cache allowed both processor and memory scores to be top-flight, while the Quantum's internal 256K buffer combined with the SCSI-2 DTC's 4MB cache to bring in one of the ultratop disk scores in these reviews. The Mach 8 coprocessor on the ATI Graphics Ultra brought in excellent numbers on the Graphics Winmark test; to its credit, it managed only slightly below-average DOS video scores.

ACMA sells its its PC exclusively through the direct channel. It has a one-year parts-and-labor warranty, free on-site service, and toll-free technical support.—*Oliver Rist*

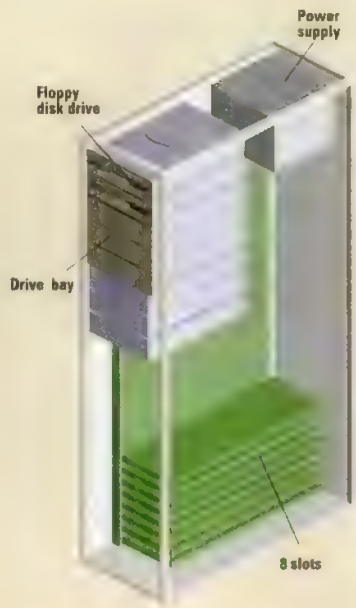
The ACMA 486SX/25

FACT FILE

ACMA 486SX/25

ACMA Computers Inc., 48501 Warm Springs Blvd., Fremont, CA 94539; 800-786-6888, 510-623-1212; fax, 510-623-0818

List price (tested configuration): $3,894.
Memory and processor RAM cache: 4MB 70-ns SIMMs, 256K cache.
Disk drives and controller: Quantum 16-ms 245MB SCSI-2 hard disk, 256K cache, 1.2MB and 1.44MB floppy disk drives.
Display: ATI 1,024-by-768 adapter with 1MB RAM, NEC 15-inch monitor, 70-Hz refresh rate.
Software: DOS 5.1, Microsoft Windows 3.1.
In short: This big EISA system, which comes with well-known brand-name components, is an excellent performer and a true high-end contender.
526 ON READER SERVICE CARD



Advanced Logic Research Inc.

ALR Flyer 32DT 4SX/25

Advanced Logic Research has certainly used some advanced logic in designing its $3,101 ALR Flyer 32DT 4SX/25. A wonderfully complete and very expandable slimline system is marred only by a couple of questionable design choices and a high price for an ISA-based system.

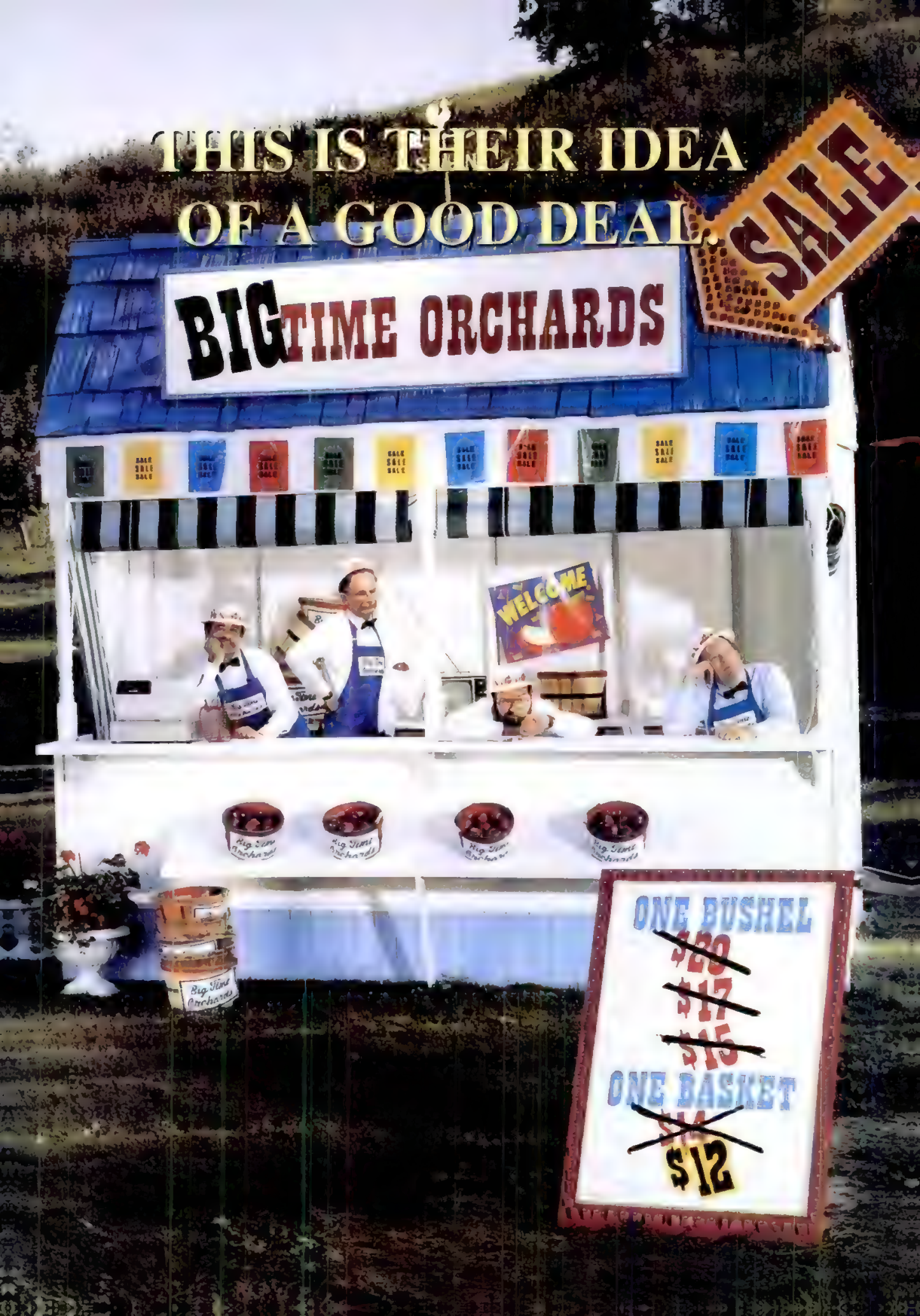
The slimline case holds one 3.5- and two 5.25-inch bays. All are occupied: Epson floppy disk drives fill two; a Maxtor 7213AT 213MB IDE hard disk fills the third. Two of the three proprietary expansion slots are free. Of the remaining three slots—16-bit ISAs—ALR has chosen (perhaps unwisely) to fill one.

That slot in our test system was taken

The ALR Flyer 32DT 4SX/25

Product Photography: Thom O'Connor

THIS IS THEIR IDEA OF A GOOD DEAL.



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GATEWAY
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Back

1. Follow instructions on the other side

Inverted Back

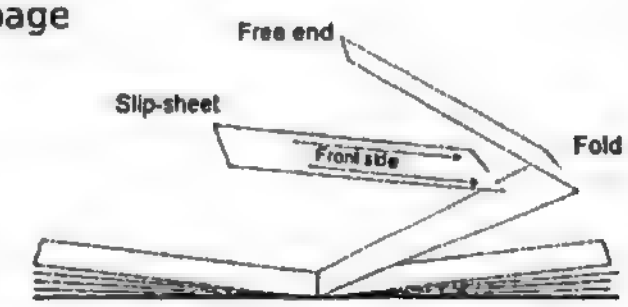
1. Follow instructions on the other side

Folded edge of the page

GbsSlipSheet-001

Foldout slip-sheet

1. Open the foldout page
2. Insert this sheet with
   1. Front side touching the free page
   2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet



Inverted Foldout slip-sheet

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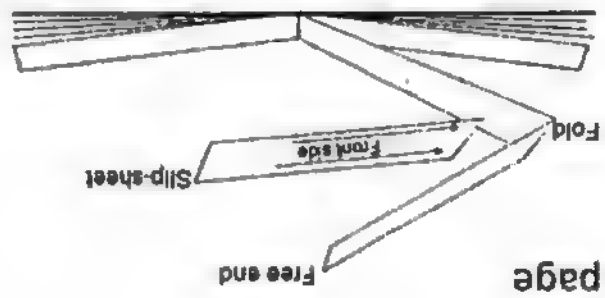
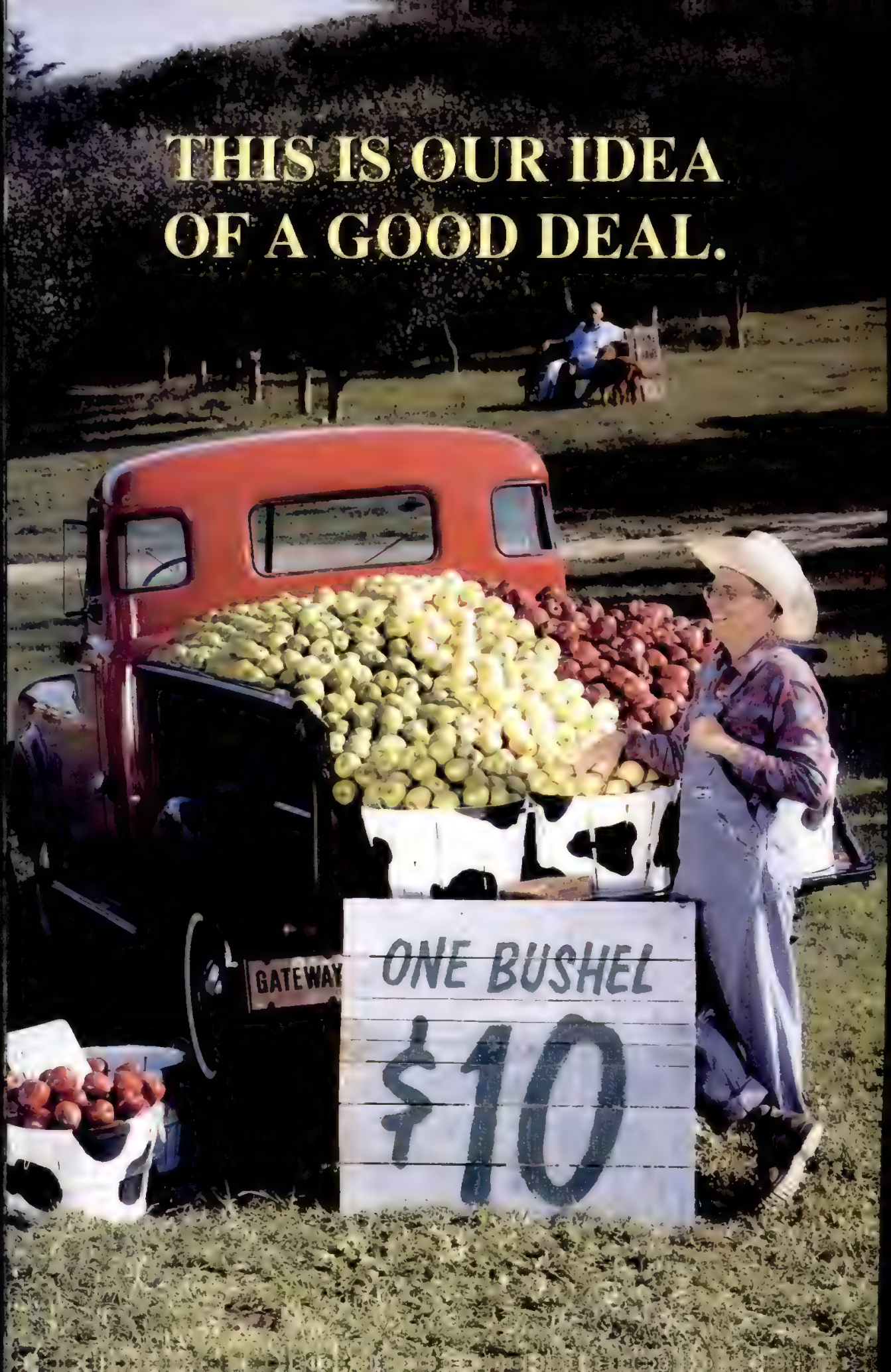
2. Insert this sheet with
   1. Front side touching the free page
   2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet



APPLES TO APPLES, YOU

The "Orchard" people are all Gateway 2000 employees, photographed at P.B. Apple Orchard in Sioux City, Iowa.


THIS IS OUR IDEA
OF A GOOD DEAL.
GATEWAY
ONE BUSHEL
$10

With all the price gouging going on in the industry, the PC crop looks luscious — but inspect closely before you bite. When you compare apples to apples, you'll find Gateway 2000 is the only company where a bushel is still a bushel. And a dollar buys more today than it did yesterday. That's value. That's the Gateway 2000 difference.

WHEN YOU'RE PICKING A PC, COMPARE PERFORMANCE AND FEATURES!

Now, more than ever, it's important to compare apples to apples before you pick your PC. You can be looking at two 486SX machines and actually be comparing an apple to an orange. What's inside makes a big difference. Other manufacturers do whatever it takes to hit a price point, and the 486SX you thought was a peach may turn out to be a lemon.

CPUs. Hard drive. Video. These subsystems have a big effect on system performance. They are also totally interrelated. One bad apple can indeed spoil the whole bunch. You also might find that extra features from one company can upset another's applecart.

The trick is to weed through PC manufacturers to find the one that's perfected the recipe. You need the right ingredients mixed together in just the right way: the smartest system features, the quality of the components, the company's strength and a reputation for the best, most knowledgeable service.

To help you peel away the hype, here are some secret recipes to help you compare performance and features:

Recipe for Peak Performance

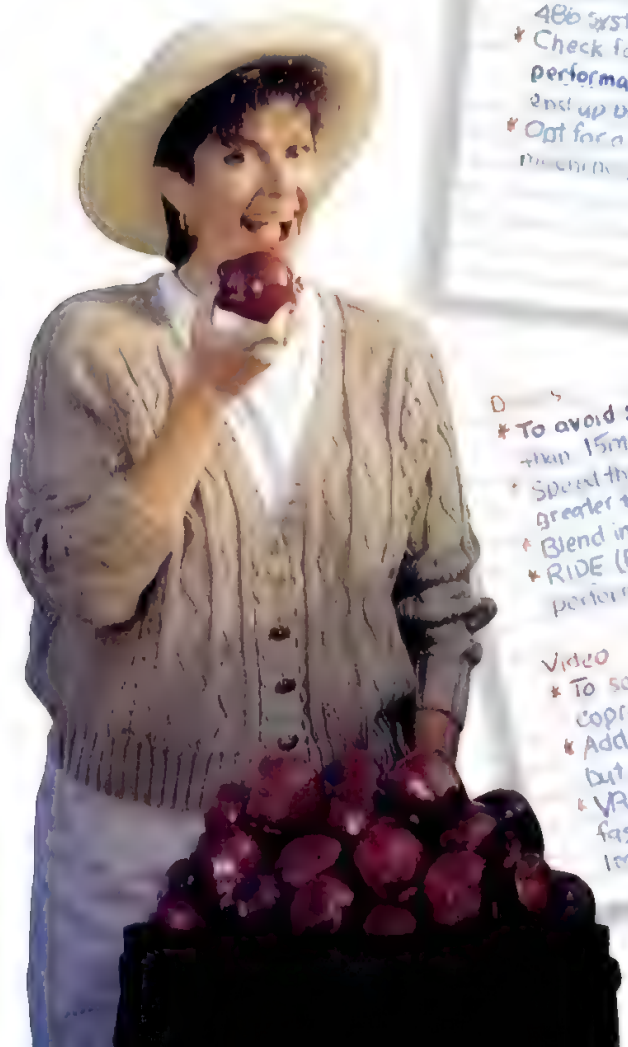
* Preset your PC for tomorrow's software by choosing a 486 system — i486 CPUs are designed for all your power-hungry applications
* Keep in mind that a 486SX 25 will outperform any 386 system on the market.
* Hint: 486 systems are easily upgradeable to higher levels of performance, that's why 90% of all Gateway customers buy 486 systems
* Check for memory cache for optimal processor and memory performance. 64K is your best choice — more than 64k could end up being table scraps.
* Opt for a clock-doubled 66 MHz 486DX2 system for the fastest machine you can buy

D...

* To avoid slow cooking, make sure your access time is less than 15ms.
* Speed things up with Data Transfer Rates (DTR) buffer to disk greater than 12Mb per second.
* Blend in at least 32k of cache.
* RIDE (Rapid Integrated Drive Electronics), Gateway's exclusive disk performance enhancement, will spike up your performance even more

Video

* To serve up the best Windows performance, look for coprocessed video.
* Adding a local bus video will give you the best video performance, but avoid proprietary local buses.
* VRAM vs. DRAM: Don't settle for stale ingredients — VRAM provides faster video implementation. But whatever you use, you'll need at least 1MB RAM for a veritable palette of colors



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WESTERN DIGITAL

Free Application Software

It's ripe for the picking at Gateway 2000! Each Nomad comes with MS Works,™ and each 486 desktop or tower system comes with your choice from the option list on the last page of this ad.

Components, peripherals and software are sold only with the purchase of a system, or to customers who already own Gateway 2000 systems. Some limitations apply.

Software options include identical applications contained in retail packages but will not include the retail box. You get all master diskettes and manuals, shrink-wrapped and packaged in a Gateway 2000 box.

Features à la Gateway

RAM
* For the best results, start out with a minimum of 4MB, although we recommend 8MB
* Make sure your machine is expandable to at least 16MB, but to really be set for the future, look for upgradeability to 64MB.

Drives
* Stir in a bare minimum of 80MB. But remember, you can never add too much — the more, the better!
* Add both 5.25" and 3.5" floppies. Make sure they're quiet and reliable.

Monitors
* Start out with a 14-inch color monitor.
* Upgrade to a 15-inch color monitor with a flat, square, non-glare screen for a larger, brighter viewing area
* Make sure your monitor supports 1024 x 768 resolution and look for a 0.28mm dot pitch.
* A non-interlaced monitor is best.

Software
* Your system should include Microsoft® DOS® 5.0 and MS Windows™ 3.1, installed and ready to run.
* Toss in your choice of free application software options pre-installed — all manuals and diskettes included.

Keyboard
* For a great combination, add a programmable keyboard with more than 101 keys. Mix in two sets of function keys.

The Top It All Off
* Refreshing custom cases in a distinctive cool gray color and contemporary design.
* A full fare of custom-written system manuals
* Don't forget agency approvals — UL, FCC Class B and CSA.
* All packaged in Gateway's own world-famous "cow-spotted" boxes.

MICROSOFT WINDOWS READY TO RUN

THE ULTIMATE TEMPTATIONS IN PORTABLE PCS

The Nomad

Your choice of a notebook depends on what you're doing away from the office. Our small, lightweight Nomad notebook computers give you desktop performance no matter where you are.

PC Magazine reports, "Geared to low power consumption, Gateway 2000's Nomad line offers excellent battery life, light weight, quality performance, and a highly competitive price."

Computer Shopper added, "The Nomad is far and away the best laptop around for getting the maximum value out of a single battery charge."

"...(it's) clearly the best general-purpose choice (for a notebook computer)."

And with our 486 Nomads, you don't have to sacrifice performance for portability. You get a bushel basket full of standard features!

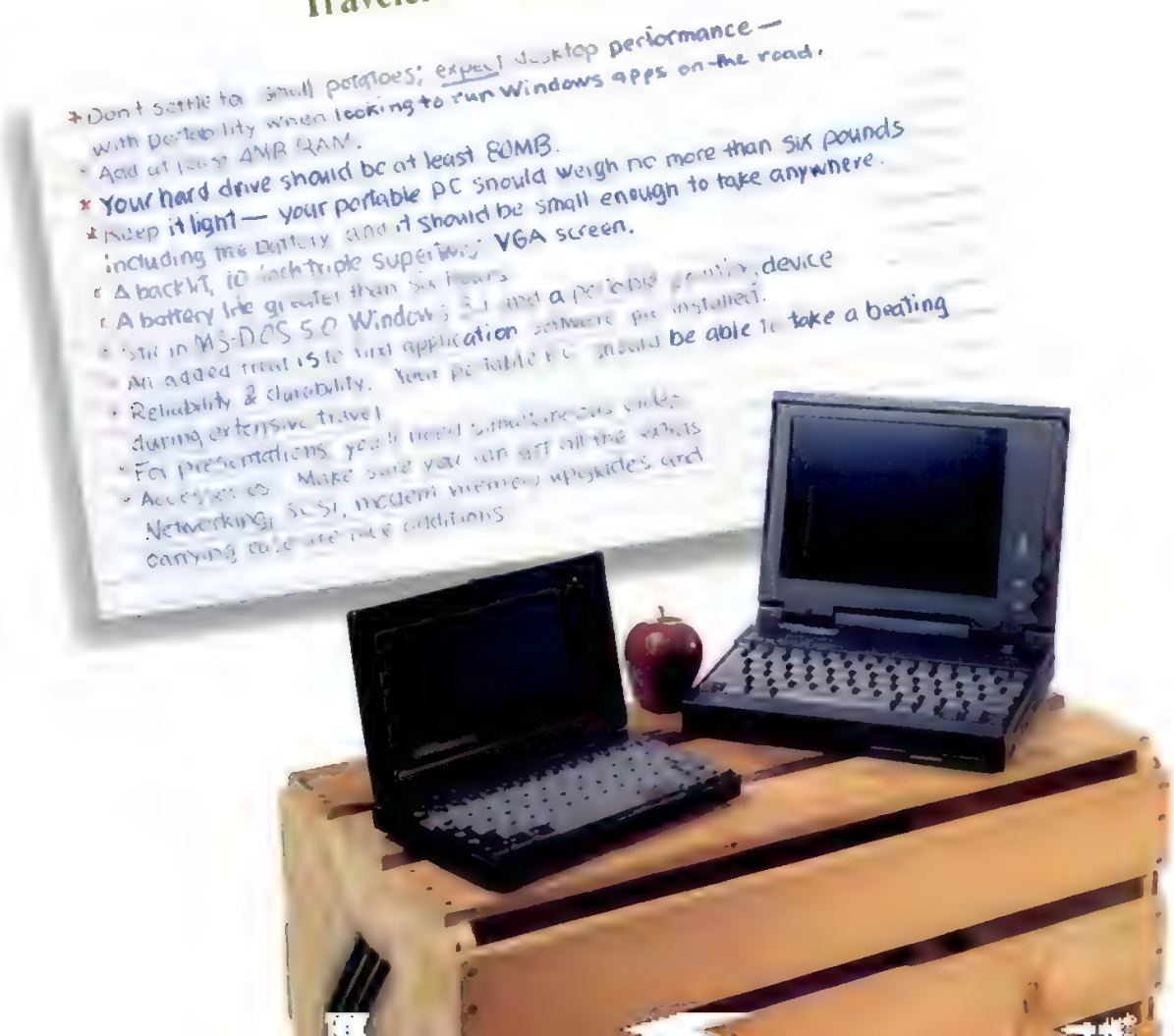
The HandBook™

Sometimes a product is so special, it's just not possible to compare it to anything else. And that's the way it is with our one-of-a-kind HandBook — a real PC in miniature form!

It weighs just 2.75 pounds and measures 6 x 9 inches. Yet it delivers 286-class performance and speedily runs all your favorite DOS applications with a bright backlit screen, a bonafide 40MB hard drive and a comfortable 78-key keyboard (no chiclet keys). And you get up to 4.5 hours battery life with power management.

Your HandBook arrives with MS-DOS® 5.0, LapLink® XL from Traveling Software, MS PC Works™, and Central Point® Desktop pre-installed and ready to run. A serial cable is included for downloading to your desktop.

Travelers' Take-Outs



An Extra Slice For Gateway Customers

Gateway customers become members of an exclusive club, able to purchase peripherals, upgrades, and additional software applications at special prices.

The 15-Inch CrystalScan 1572FS

A flat, square, non-glare screen reduces distortion around the corners and provides edge-to-edge display – an upgrade option with the purchase of any Gateway 2000 desktop system for an additional **$195**.

The Gateway 2000 TelePath™ Fax/Modem

A 14,400 bps mode, V .32bis, with 9,600 bps fax capability. The TelePath comes with WinFax Pro™, Crosstalk™ for Windows, Qmodem™ and a free 30-day basic services CompuServe® membership – all for only **$195**!

More Software At Great Prices

The following applications are available with the purchase of a system, or to Gateway customers.

Central Point® Anti-Virus 1.2 for Windows $75

Central Point Backup™ 7.2 for Windows $75

The Norton Desktop™ 2.0 and Prisma YourWay 2.0 for Windows *(personal information manager)* **$95**

Also available – tape backups, printers and other peripherals. Call for details.

The Extras — That Don't Cost Extra From Gateway

- One-year limited warranty
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- Lifetime toll-free technical support
- Free BBS lifetime membership
- Payment options — major credit cards and C.O.D. terms; net 30-day credit terms and leasing options are available to qualified commercial customers.

Your No-Fail Recipe for Satisfaction

* Start with a company that's not half baked. The PC business is full of manufacturers who are finding it difficult to succeed. It's a rough road for smaller manufacturers, especially when some big-name manufacturers are having difficulties. With Gateway 2000, you get a financially-sound, proven company with one of the best balance sheets in the industry.
* Combine Midwestern work ethics and ingenuity with liberal amounts of buying power to bring you the latest technology at unbeatable prices.
* Look for quality, top of-the line components and outstanding performance features when choosing the right company. Reference PC Magazine's reliability survey – Gateway customers gave their systems the highest rating among 35 of the nation's top PC manufacturers.
* Find the best service possible. Customers gave Gateway the highest satisfaction rating in PC Magazine's service survey scoring "significantly better than any other manufacturer" when asked "Would you buy again from the same manufacturer?"

Sorry, we sell peripherals only with the purchase of a Gateway 2000 system, or to people who are already Gateway 2000 customers.

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- 25MHz, 386SXL Processor
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- 1.44MB 3.5" Drive
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- Simultaneous Video with 256K
- Size 8.5" x 11" x 1.8", 5.8 Lbs.
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- 1 Parallel/1 Serial Port
- 79-Key Keyboard
- FieldMouse™ Pointing Device
- MS DOS® 5.0 and Windows™ 3.1
- MS Works™ for Windows

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[illegible]

- 20MHz, Intel 486SXLP Processor
- 4MB RAM
- 1.44MB 3.5" Drive
- 80MB IDE Hard Drive
- Backlit 10" VGA Screen, 64 Grays
- Simultaneous Video with 1MB
- Size 8.5" x 11" x 1.8", 5.8 Lbs.
- 6-Hr.* NiCad Battery & AC Pack
- 1 Parallel/1 Serial Port
- 79-Key Keyboard
- FieldMouse Pointing Device
- MS DOS 5.0 and Windows 3.1
- MS Works™ for Windows

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[illegible]

- 25MHz, Intel 486DXLP Processor
- 4MB RAM
- 1.44MB 3.5" Drive
- 120MB IDE Hard Drive
- Backlit 10" VGA Screen, 64 Grays
- Simultaneous Video with 1MB
- Size 8.5" x 11" x 1.8", 5.8 Lbs.
- 6-Hr.* NiCad Battery & AC Pack
- 1 Parallel/1 Serial Port
- 79-Key Keyboard
- FieldMouse Pointing Device
- MS DOS 5.0 and Windows 3.1
- MS Works™ for Windows

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DESKTOPS

25MHz 386SX

- Intel 386SX Processor
- 4MB RAM
- 1.2MB & 1.44MB Drives
- 80MB 15ms IDE Cache Drive
- 16-Bit SVGA with 1MB
- 14" CrystalScan 1024 Color VGA Monitor
- 1 Parallel/2 Serial Ports
- 124-Key AnyKey™ Keyboard
- Microsoft® Mouse
- MS DOS 5.0 and Windows 3.1
- MS Works for Windows

$1345

25MHz 486SX

- Intel 486SX Processor
- 4MB RAM
- 1.2MB & 1.44MB Drives
- 120MB 13ms IDE** Cache Drive
- ATI™ Graphics Ultra with 1MB
- 14" CrystalScan 1024NI Color VGA Monitor
- 1 Parallel/2 Serial Ports
- 124-Key AnyKey Keyboard
- Microsoft Mouse
- MS DOS 5.0 and Windows 3.1
- Choice of Application Software

$1795

33MHz 486DX

- Intel 486DX Processor
- 64K Memory Cache
- 4MB RAM
- 1.2MB & 1.44MB Drives
- 200MB 13ms IDE** Cache Drive
- ATI Graphics Ultra with 1MB
- 14" CrystalScan 1024NI Color VGA Monitor
- 1 Parallel/2 Serial Ports
- 124-Key AnyKey Keyboard
- Microsoft Mouse
- MS DOS 5.0 and Windows 3.1
- Choice of Application Software

$2295

50MHz 486DX2

- Intel 486DX2 Processor
- 64K Memory Cache
- 8MB RAM
- 1.2MB & 1.44MB Drives
- 200MB 13ms IDE** Cache Drive
- ATI Graphics Ultra with 1MB
- 14" CrystalScan 1024NI Color VGA Monitor
- 1 Parallel/2 Serial Ports
- 124-Key AnyKey Keyboard
- Microsoft Mouse
- MS DOS 5.0 and Windows 3.1
- Choice of Application Software

$2595

66MHz 486DX2

- Intel 486DX2 Processor
- 64K Memory Cache
- 8MB RAM
- 1.2MB & 1.44MB Drives
- 340MB 13ms IDE** Cache Drive
- Ultra Fast Local Bus Video
- 15" CrystalScan 1572 Color VGA Monitor
- 1 Parallel/2 Serial Ports
- 124-Key AnyKey Keyboard
- Microsoft Mouse
- MS DOS 5.0 and Windows 3.1
- Choice of Application Software

$2995

66MHz 486DX2 EISA

- Intel 486DX2 Processor
- 128K Memory Cache
- 8MB RAM
- 1.2MB & 1.44MB Drives
- 340MB 15ms SCSI Cache Drive
- 32-Bit EISA SCSI Controller
- 16-Bit SVGA with 1MB
- 14" CrystalScan 1024NI Color VGA Monitor
- 1 Parallel/2 Serial Ports
- 124-Key AnyKey Keyboard
- Microsoft Mouse
- MS DOS 5.0 and Windows 3.1
- Choice of Application Software
- Tower Model is Standard

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- MS Word for Windows™ 2.0
- MS PowerPoint for Windows™ 3.0
- MS Project for Windows™ 3.0
- Borland Paradox® 4.0 and Turbo Pascal 1.5 or C++® 3.1
- The MS Entrepreneur Pack *(Works,™ Publisher,™ Money™ and Games)*
- The Windows Programmer Pack *(MS QuickC,™ Visual Basic, and More)*
- MS Office™ *(Word, Excel, and PowerPoint) Available as an upgrade replacing any above option.*

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** Battery life was measured using PC Magazine's Battery Rundown Test with power management enabled. Actual results may vary.*

GATEWAY2000

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up with an optional UltraStor 15C IDE pass-through connector with a 512K cache. An uncached IDE connector is integrated onto the motherboard, as are video and I/O. The resident proprietary card is a modular upgrade card holding the CPU (in this case, Intel's special plastic KU80486SX-25 chip that reputedly reduces heat), an OverDrive upgrade socket, and up to 36MB of RAM. Though no secondary cache came with our test unit, the second proprietary slot allows you to upgrade to one. The last slot is for fast SCSI interfaces and other future upgrade products. Video is handled onboard by a Western Digital WD90C30/25 chip set with 1MB of video RAM. In a price/performance compromise, ALR allowed this to be hooked to a 14-inch FlexView 3X monitor, capable of only 800-by-600 resolution at 72 Hz.

Performance was fairly good on our processor and memory benchmark tests, considering that the unit didn't use a secondary cache. Hard disk performance was above average, as was DOS video performance. Its Graphics Winmark result was poor, though, as expected with the Western Digital chip set. At press time, ALR reported it was planning to release a new version of this system in August, equipped with the WD90C31 GUI-accelerating video chip set.

All ALR systems come with a one-year warranty on parts and labor; on-site service from Idea ServCom is $35 the first year. ALR maintains toll-free technical support weekdays and Saturdays, as well as a BBS and a fax service. If you don't mind the higher-than-average price, this machine is a fine choice.—*OR*

FACT FILE

ALR Flyer 32DT 4SX/25

Advanced Logic Research Inc., 9401 Jeronimo, Irvine, CA 92718; 800-444-4257, 714-581-6770; fax, 714-581-9240

List price (tested configuration): $3,101.

Memory and processor RAM cache: 4MB 80-ns integrated DIPs.

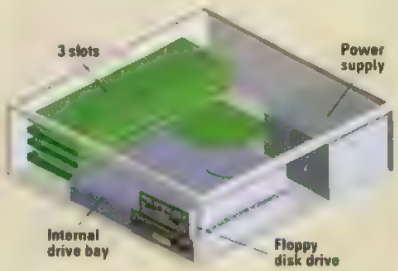
Disk drives and controller: Maxtor 15-ms 213MB IDE hard disk, 64K buffer, UltraStor controller, 512K cache, 1.2MB and 1.44MB floppy disk drives.

Display: 1,024-by-768 video with 1MB RAM integrated on motherboard, ALR 14-inch monitor, 72-Hz refresh rate

Software: DOS 5.0, Microsoft Windows 3.1.

In short: The slimline ALR Flyer 32DT 4SX/25 has a highly integrated motherboard and a modular, upgradable CPU design. It's a good performer, but the high price could have bought some higher-quality components, notably a better monitor.

527 ON READER SERVICE CARD



Amax Engineering Corp.

Amax 486SX/25 Power Station

A very low-priced EISA desktop, the $2,499 Amax 486SX/25 Power Station manages to provide all the basics at a price rivaling low-cost ISA systems.

Two 5.25-inch bays hold the floppy disk drives; another holds the 245MB Quantum ProDrive IDE hard disk.

System memory, expandable from 1MB to 64MB, is backed by a 256K secondary cache. Three of the eight EISA slots on the Amax motherboard are filled: one holds a cacheless DTC IDE pass-through hard disk controller; another has a Tseng ET4000–based Diamond SpeedSTAR video adapter with 1MB of video RAM. The third takes an 8-bit I/O card. Remarkable only for its awkward placement, it sits in the very first expansion slot; the cabling it thus requires runs the width of the interior and forces any expansion cards to squeeze beneath it. A mediocre 14-inch Impression Plus 1448 multiscanning monitor handles 1,024-by-768 resolution only at 60 Hz.

The Amax 486SX/25 Power Station

Performance was precisely what you would expect from these components. Processor and memory scores were tightly grouped with the rest of the crowd. Hard disk performance was boosted slightly above average by the 32-bit DTC IDE controller even without an external cache. The Diamond SpeedSTAR turned in its usual ET4000 chip set results: good performance on our video test and a dismal score on our Graphics Winmark test.

Amax Engineering Corp. sells mostly through dealers, though some corporations can buy direct. A one-year parts-

FACT FILE

Amax 486SX/25 Power Station

Amax Engineering Corp., 47315 Mission Falls Ct., Fremont, CA 94539; 800-888-2629, 510-651-8886; fax, 510-651-3720

List price (tested configuration): $2,499

Memory and processor RAM cache: 4MB 70-ns SIMMs, 256K cache.

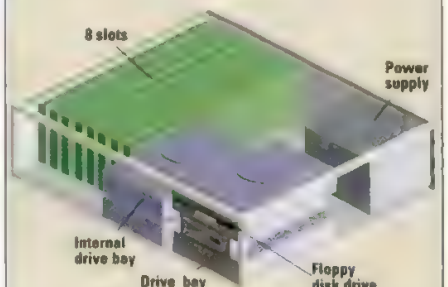
Disk drives and controller: Quantum 16-ms 245MB IDE hard disk, 256K cache, 1.2MB and 1.44MB floppy disk drives

Display: Diamond 1,024-by-768 adapter with 1MB RAM, Impression Plus 14-inch monitor, 60-Hz refresh rate

Software: DOS 5.0, Microsoft Windows 3.1.

In short: The Amax 486SX/25 Power Station is an average EISA machine that is aimed entirely at the price equation. It may have fulfilled its purpose, but in doing so this PC neither soars nor sinks.

528 ON READER SERVICE CARD



and-labor warranty accompanies the unit; on-site service from TRW costs $125. Toll-free technical support is available Pacific time weekdays.—*OR*

Amkly Systems Inc.

Amkly 486SX/25E

The $3,250 Amkly 486SX/25E seems a decent choice at first glance. But other EISA systems in this review group that cost only a few hundred dollars more offer more consistent performance.

The small-footprint case holds two 5.25- and two 3.5-inch bays.

Amkly's own motherboard uses a Phoenix BIOS (upgradable through flash memory). It holds six EISA slots (five left free) and one proprietary slot reserved for the CPU and memory card. Another standard EISA slot has a proprietary extender for memory expansion. The CPU card holds the processor and a Weitek socket. The CPU socket can hold any 486 CPU, differentiating between them via jumpers. The Micropolis 345MB ESDI hard disk is attached to an UltraStor USC22C EISA controller equipped with a 512K read-ahead cache. I/O ports and video are integrated onto the system board, the latter providing a Trident chip set, 1MB RAM, and resolutions up to 1,024-by-768 noninterlaced. The 14-inch monitor carries the Amkly name but is not as well designed as the rest of the system. Only the brightness and contrast controls are front-mounted; size and phase controls are rear-mounted and inset, requiring tools to adjust.

Despite the lack of a secondary cache, processor and memory scores were average. Disk and video scores were also average.

Amkly distributes through dealers; the standard one-year warranty includes free on-site service from Texas Instruments. Technical support is toll-free and includes a 24-hour BBS.—*OR*

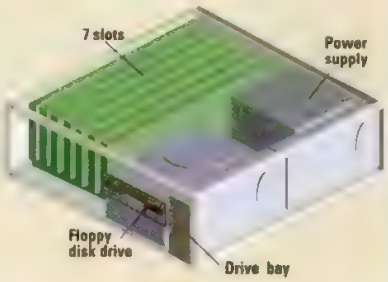
The Amkly 486SX/25E

FACT FILE

Amkly 486SX/25E

Amkly Systems Inc., 60 Technology Dr., Irvine, CA 92718; 800-367-2655, 714-727-0788

List price (tested configuration): $3,250.
Memory and processor RAM cache: 8MB 70-ns SIMMs
Disk drives and controller: Micropolis 14-ms 345MB ESDI hard disk with 4MB cache, UltraStor controller, 512K cache, 1.2MB and 1.44MB combination floppy disk drive
Display: 1,024-by-768 video with 1MB RAM integrated on motherboard, Amkly 14-inch monitor, 70-Hz refresh rate
Software: DOS 5.0, Microsoft Windows 3.1.
In short: Although the EISA-based Amkly 486SX/25E is a neat-looking PC, its performance is just average.
529 ON READER SERVICE CARD



Arche Technologies Inc.

Arche Legacy 486SX/25

Though somewhat uninspired, the Arche Legacy 486SX/25 provides all the basics. A competitive price might mitigate some of its drawbacks; but at $4,521, it's a couple thousand dollars more than most of the systems in this 58-machine roundup.

The standard desktop case has three accessible 5.25-inch bays; the lone floppy disk drive is a 3.5-inch unit. A Western Digital Piranha 4200 200MB IDE hard disk fills the only internal bay, a side-mounted 3.5-inch half-height.

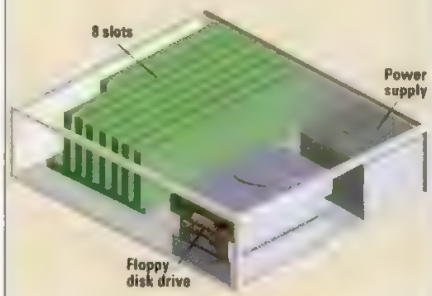
Arche uses its own motherboard, which has an AMI BIOS, 4MB RAM (8MB maximum), and a nonexpandable 128K secondary cache. Intel's 486SX 25-MHz processor is neighbored only by a Weitek socket. If you've got OverDrive

FACT FILE

Arche Legacy 486SX/25

Arche Technologies Inc., 48881 Kato Rd., Fremont, CA 94539; 800-437-1688, 510-623-8100; fax, 510-683-6754

List price (tested configuration): $4,521.
Memory and processor RAM cache: 4MB 80-ns SIMMs, 128K cache.
Disk drives and controller: Western Digital 15-ms 200MB IDE hard disk, 1.2MB and 1.44MB floppy disk drives
Display: Diamond 1,024-by-768 adapter with 1MB RAM, Arche 14-inch monitor, 70-Hz refresh rate
Software: DOS 5.0, Microsoft Windows 3.1.
In short: An unremarkable machine in the performance department, the Arche Legacy 486SX/25's only outstanding feature is the stratospheric price tag attached to it.
530 ON READER SERVICE CARD



The Arche Legacy 486SX/25

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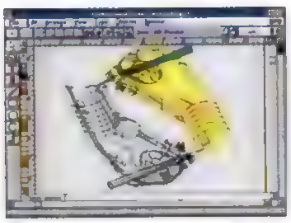

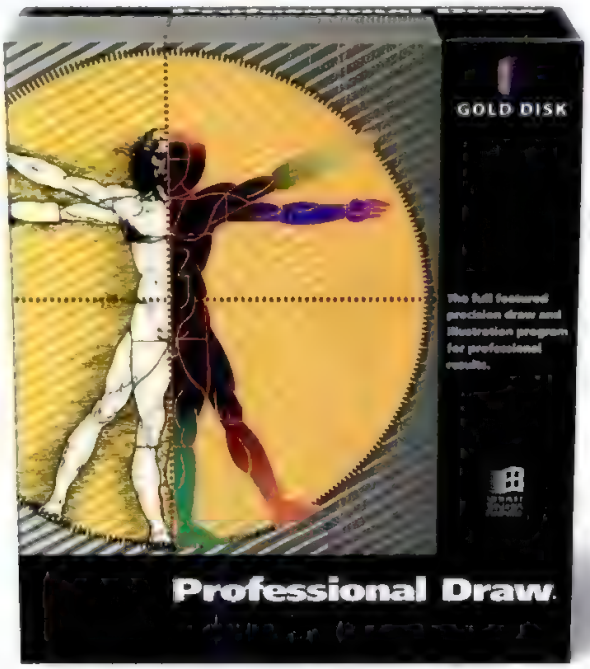

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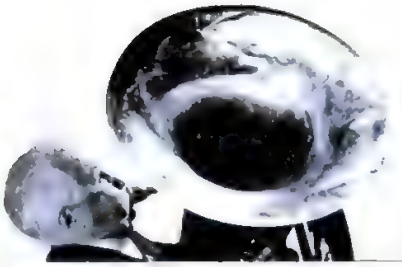
CIRCLE 207 ON READER SERVICE CARD



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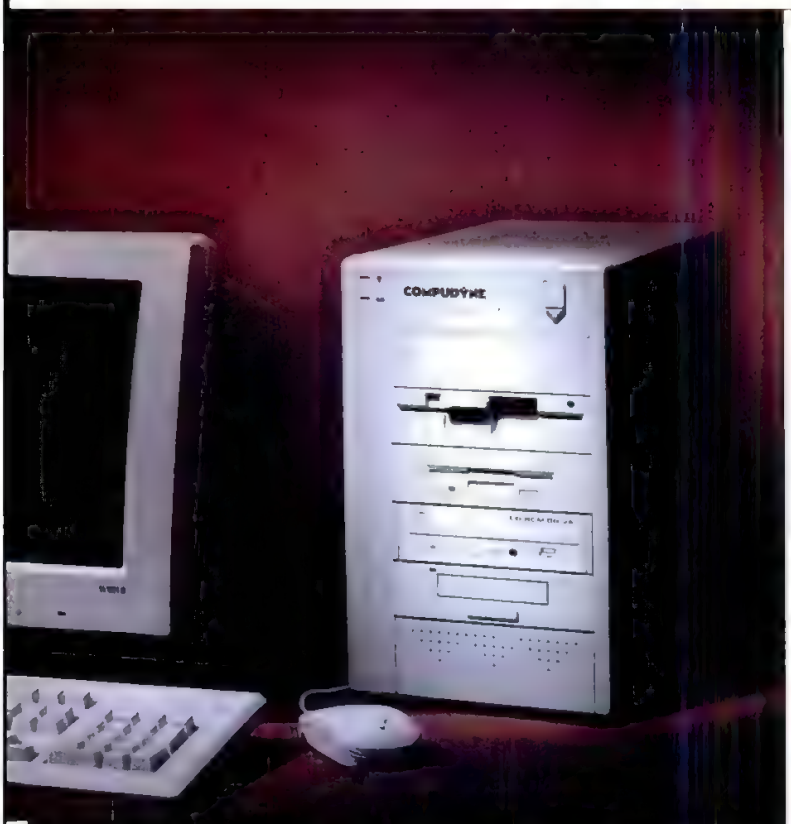

Desktop	CPU	RAM (MBs)	HD (MBs)	Floppy	Display	Price
386SX/25	Intel 80486SX–25 MHz	1 standard 32 max	50	1.2 or 1.44	16 bit SVGA card 14" 640x480 VGA Color Monitor	$899** $33/mo*
386DX/33	Intel 80386DX–33 MHz	2 standard 32 max	80	as above	as above	$999 $37/mo*
486SX/25	Intel 80486SX–25 MHz Built-in 8K CPU cache	as above	105	1.2 & 1.44	16 bit SVGA card 14" 1024x768 SVGA Color Monitor	$1,299 $44/mo*
386DX/33 CACHE	Intel 80386DX–33 MHz 64K CPU cache EXTRA CACHE	4 standard 32 max	105	as above	16 bit SVGA card w/ 1MB video RAM & Hi-Color Support 14" 1024x768 SVGA Non-Interlaced Multisync Color Monitor	$1,499 $56/mo*
486DX/33 CACHE	Intel 80486DX–33 MHz 128K CPU cache	4 standard 64 max	130	as above	as above	$1,799 $67/mo*
486DX2/50 CACHE	Intel 80486DX2–50 MHz 128K CPU cache New Double Clock CPU	as above	130	as above	as above	$1,999 $74/mo*
486DX/50 CACHE	Intel 80486DX-50 MHz 128K CPU cache True 50 MHz CPU	8 standard 64 max	210	as above	as above	$2,499 $89/mo*
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CIRCLE 132 ON READER SERVICE CARD

aspirations, you'd better be prepared to pull chip A in order to insert chip B. Moreover, chip B had better be one of those OverDrive chips designed to fit into a normal 486 or 487 socket, not one of the ones made to fit specifically into an OverDrive socket. Two of the eight 16-bit ISA slots are occupied by a multifunction IDE pass-through connector (including I/O ports) and a Diamond SpeedSTAR video card. Arche's monitor is the usual 14-inch fixed-frequency Super VGA affair capable of 1,024-by-768 resolution at 70 Hz. DOS 5.0 and Windows 3.1 accompany this system.

Processor and memory scores were average, while the Western Digital hard disk scored below average—probably because it lacked a cache. As expected, the Tseng ET4000 chip on the SpeedSTAR card was above average on DOS, below average on Windows.

About all that does stand out about the Legacy is its warranty: two years on parts-and-labor with free on-site service. Unfortunately, Arche can't rely on its warranty to sell systems. For this kind of money, the motherboard's I/O, disk controller, and video should be integrated. It needs components that are a little more cutting edge than just a plain uncached IDE hard disk and ET4000-based video.—*OR*

Ariel Design Inc.

Ariel 486SX/25

The name Ariel Design doesn't roll off the tip of the tongue like the names of other major PC vendors, but it could. The company is young—founded in Hanover, Massachusetts, in 1990—but its products are mature in quality and performance. The ISA-based $2,290 Ariel 486SX/25, which comes with 4MB of RAM, a 234MB Quantum hard disk, and 256K of secondary cache, is no exception. This system is so neatly packed and filled with features that it could appeal to a wide range of users.

The Ariel 486SX/25

The 19-inch-high mini-tower is a pleasure to have around for aesthetic and space-saving reasons, yet it gives up nothing in expansion possibilities. Eight 16-bit slots (six open in our test system) fit smartly into this case. Parallel to them are two memory slots that can hold 64MB of RAM SIMMs. Meanwhile, the secondary cache fits into a proprietary slot at the bottom of the unit. Four standard-height drive bays are front-accessible; two more nestle below them internally. The CPU is easy to reach, as is the OverDrive socket.

The Ariel's performance was excellent. Its processor and memory scores were near the top of the class, while its disk score slipped into the average range. The Diamond Stealth VRAM adapter with 1MB of video RAM and an S3 chip set performed superbly on the Graphics Winmark test but slightly below par on our our DOS-based video test—the norm for S3 chip–based designs.

Documentation for the feature-rich Ariel is extensive. The system comes with DOS 5.0, Microsoft Windows 3.1, and a Microsoft mouse all ready to go. We would have liked another cooling fan blowing over the motherboard, but we didn't encounter any problems with the unit overheating.

The 14-inch ViewSonic 6 monitor can be replaced with a 15-inch MAG or a 17-inch ViewSonic 7 for $270 and $800, respectively. Video adapter options include the Diamond Stealth Hi-Color and the Number 9 GXi Lite for $100 and $795, respectively.

On-site service is available free from TRW, and the warranty covers parts and labor for one year. Toll-free technical support is available from 9:00 to 7:00 eastern Monday through Thursday and 9:00 to 6:00 on Fridays.—*Brad Grimes*

PC MAGAZINE EDITORS' CHOICE

FACT FILE

Ariel 486SX/25

Ariel Design Inc., 145 Webster St., Hanover, MA 02339; 800-882-7435, 617-982-8800; fax, 617-982-9095

List price (tested configuration): $2,290

Memory and processor RAM cache: 4MB 80-ns SIMMs, 256K cache

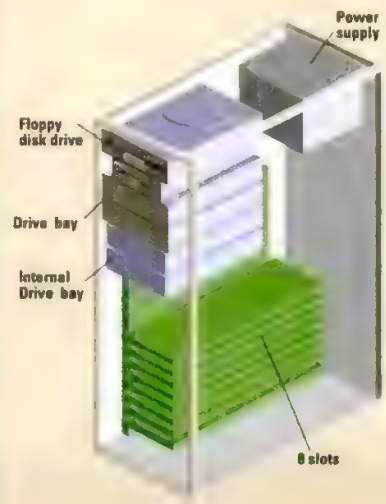
Disk drives and controller: Quantum 16-ms 234MB IDE hard disk, DFI controller, 256K cache, 1.2MB and 1.44MB floppy disk drives.

Display: Diamond 1,024-by-768 adapter with 1MB RAM, ViewSonic 14-inch monitor, 60-Hz refresh rate

Software: DOS 5.0, Microsoft Windows 3.1.

In short: Packed with features and exhibiting high performance scores, the Ariel 486SX/25 could put this growing company on the map

531 ON READER SERVICE CARD



Atlas Industries Inc.

Atlas 486SX/25

The ISA-based Atlas 486SX/25 offers an attractive appearance and average performance. The $1,999 test unit, which came with 8MB of RAM, a 210MB hard disk, DOS 5.0, and Microsoft Windows 3.1, got off to an inauspicious start because many of its cards and drivers were mismatched, but it performed adequately thereafter.

The beige desktop unit has some nice external touches, such as rounded corners and decorative modeling on the case. Drive bays number five external and one internal. On the motherboard are eight 16-bit expansion slots, the CPU, an OverDrive socket, and an 80-pin connector for an external cache card. You

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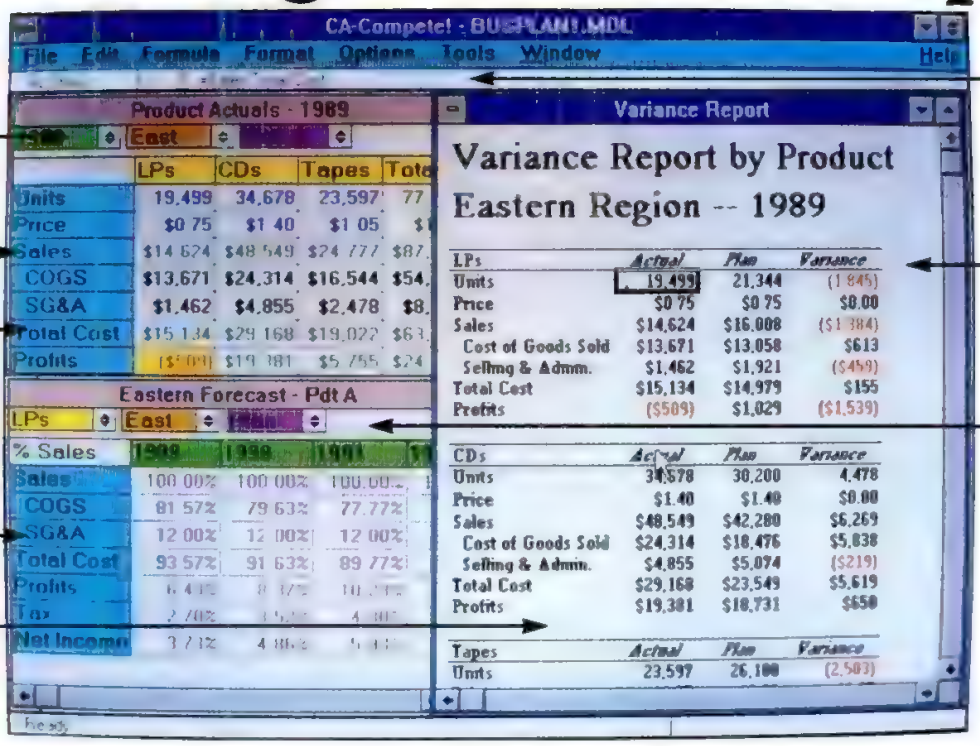

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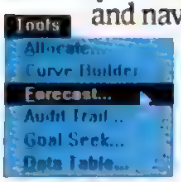

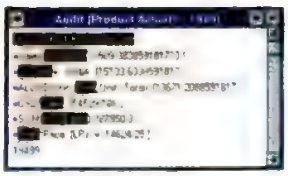

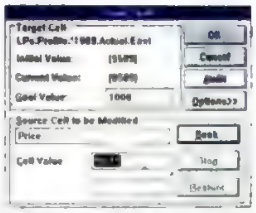

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CIRCLE 381 ON READER SERVICE CARD

can expand system RAM to 64MB. The Orchid Fahrenheit video board is S3 chip–based for accelerated Windows performance.

Performance scores were representative of the system components, though the disk score was poor. Coaxing any performance at all from the unit was something of a chore; the company sent the wrong I/O card (but the right documentation) and the wrong video drivers.

Mix-ups notwithstanding, the Atlas was a solid unit once its components were in order. DOS 5.0 and Windows 3.1 ship with the machine, as does an AT-bus card. The NMB Technologies keyboard is decent, and we found this machine pleasant to use. Though performance isn't outstanding, this machine's price is definitely appealing.

For $50, you can add a year of on-site service from US Onsite to the one-year warranty on parts and labor, or you can get three years of coverage for $100. A toll-free line handles technical support weekdays.—*Angela Gunn*

The Atlas 486SX/25

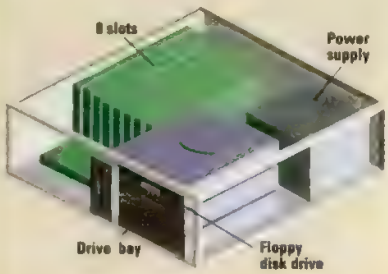
FACT FILE

Atlas 486SX/25

Atlas Industries Inc., 6405 Independence Ave., Woodland Hills, CA 91367; 800-285-2711, 818-710-1980; fax, 310-479-2334

List price (tested configuration): $1,999
Memory and processor RAM cache: 8MB 80-ns SIMMs, 256K cache
Disk drives and controller: Maxtor 16-ms 210MB IDE hard disk, Atlas controller, 64K cache, 1.2MB and 1.44MB floppy disk drives.
Display: Orchid 1,280-by-1,024 adapter with 1MB RAM, Optiquest 14-inch monitor, 72-Hz refresh rate.
Software: DOS 5.0, Microsoft Windows 3.1.
In short: The Atlas 486SX/25 is a nondescript system with good components at a competitive price. It could use more attention to detail

532 ON READER SERVICE CARD



ATronics International Inc.

ATronics ATI 486SX-25

The $1,775 ISA-based ATronics ATI 486SX-25 represents an uncommon approach to making PCs. ATronics International is known for modifying an ordinary chassis and hard disks to create a removable hard disk system—a resourceful measure that enhances an ordinary small-footprint PC. Removable mass media works best in any setting where security is critical, systems have to be shared, and huge amounts of data need to be transported. That need makes the ATI's idiosyncrasy its marketing hook.

The ATI uses a hard plastic carrier to adapt the included Seagate 211MB hard disk. The handled carrier slides into the bay space normally occupied by an accessible 5.25-inch half-height. System and peripheral expansion in this eight-slot, 16-bit machine is little affected by the removable disk scheme. The system comes with 4MB of RAM and 64K of direct-mapped, write-back cache. System memory expands to 64MB through a proprietary memory card; cache memory expands to 256K. An S3 chip–based Diamond Stealth VRAM adapter and a ViewSonic monitor make up the video subsystem. There's room for two additional drives beyond the first three.

On our benchmark tests, the ATI picked up average processor scores and low memory scores because of its small external cache. Similarly, the absence of a caching disk controller pushed the disk scores for the Seagate hard disk below average. True to form, the Diamond Stealth VRAM adapter posted a high Graphics Winmark score and a low DOS video score.

Regrettably, the documentation is not adequate. But with a motherboard upgradable to either a 50-MHz DX2

The ATronics ATI 486SX-25

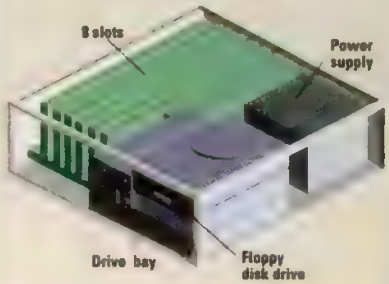
FACT FILE

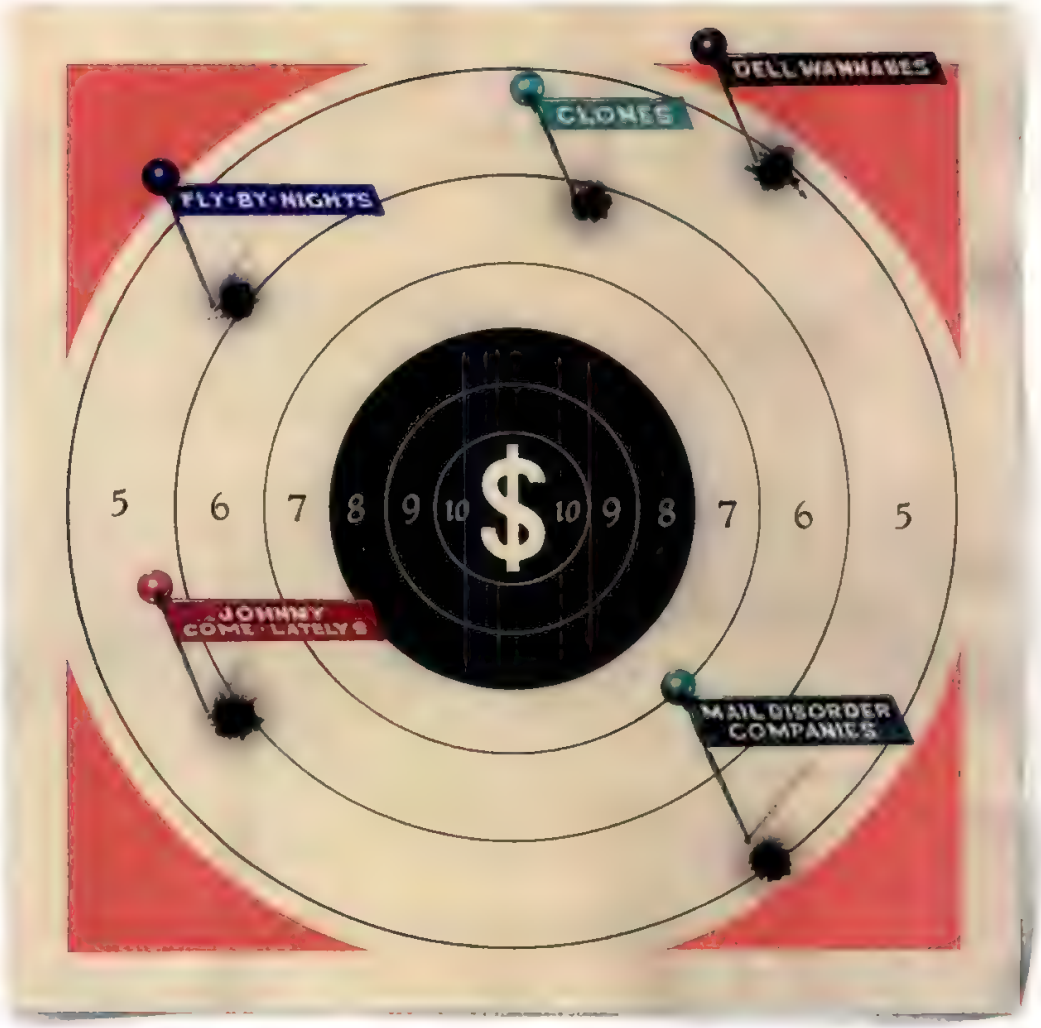
ATronics ATI 486SX-25

ATronics International Inc., 45635 Northport Loop East, Fremont, CA 94538; 800-488-7776, 510-656-8400; fax, 510-656-8560

List price (tested configuration): $1,775.
Memory and processor RAM cache: 4MB 70-ns SIMMs, 64K cache.
Disk drives and controller: Seagate 15-ms 211MB IDE hard disk, 1.2MB and 1.44MB floppy disk drives
Display: Diamond 1,024-by-768 adapter with 1MB RAM, ViewSonic 14-inch monitor, 56-Hz refresh rate.
Software: None
In short: ATronics International adds value to its system by creatively adapting a standard hard disk and chassis to make a machine with a removable hard disk—for a good price.

533 ON READER SERVICE CARD





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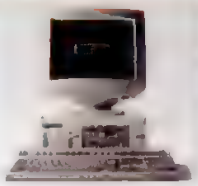
4 MB RAM, 212 MB Hard Drive,
6 Drive Bays, 6 Expansion Slots,
Dual Floppy Drives (3.5" and 5.25"), Ultra VGA 1024NI Monitor (14", 1024 x 768, .28mm),
MS-DOS 5.0/Microsoft Windows 3.1/Mouse



DIMENSION 386SX/25
$1,259
Lease: $47/MO

i386™SX 25 MHz System
2 MB RAM, 80 MB Hard Drive,
3 Drive Bays, 4 Expansion Slots,
Dual Floppy Drives (3.5" and 5.25"), Super VGA 1024I Monitor (14", 1024 x 768, .28mm),
MS-DOS 5.0/Microsoft Windows 3.1/Mouse

DIMENSION NL20
$1,499
Lease: $55/MO

i386SL 20 MHz System*
2 MB RAM, 40 MB Hard Drive,
Weight: 6.3 lbs. including battery,
Minimum battery life: 2.5 hours,
Edgelit VGA LCD (8.5" Diagonal, 640 x 480), MS-DOS 5.0/Microsoft Windows 3.1/Mouse

DIMENSION 486DX/33s
$2,699
Lease: $100/MO.

i486DX 33 MHz System
8 MB RAM, 212 MB Hard Drive,
6 Drive Bays, 6 Expansion Slots,
64 KB Cache, Dual Floppy Drives (3.5" and 5.25"), Ultra VGA 1024NI Monitor (14", 1024 x 768, .28mm), MS-DOS 5.0/Microsoft Windows 3.1/Mouse

DIMENSION 386SX/25
$1,449
Lease: $54/MO.

i386SX 25 MHz System
4 MB RAM, 120 MB Hard Drive,
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Dual Floppy Drives (3.5" and 5.25"), Super VGA 1024I Monitor (14", 1024 x 768, .28mm),
MS-DOS 5.0/Microsoft Windows 3.1/Mouse

DIMENSION NL25
$1,799
Lease: $67/MO.

i386SL 25 MHz System*
2 MB RAM, 60 MB Hard Drive,
64 KB Cache, Weight: 6.3 lbs. including battery, Minimum battery life: 2.5 hours, Edgelit VGA LCD (9.5" Diagonal, 640 x 480),
MS-DOS 5.0/Microsoft Windows 3.1/Mouse

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Model	486DX/33	4/33 Mod 120	33 MHz 486DX	Upgradeable 486DX-33
Microprocessor	i486DX 33 MHz	i486DX 33 MHz	i486DX 33 MHz	i486DX 33 MHz
RAM	4 MB	4 MB	4 MB	4 MB
Hard Disk Drive	120 MB	120 MB	120 MB	130 MB
Drive Bays	5	3	5	7
Expansion Slots	6	3	8	8
External Cache	64K	0	64K	0
Monitor	Ultra VGA 1024 (14", 1024 x 768, 28mm, non-interlaced)	Compaq 1024 Color Monitor (14", 1024 x 768, 28mm, non-interlaced)	Crystal Scan 1024NI VGA Color Monitor (14", 1024 x 768, .28mm, non-interlaced)	Zeos Color VGA (14", 1024 x 768, 28mm, non-interlaced)
Software/ Operating System	Microsoft Windows 3.1 MS-DOS 5.0	Microsoft Windows 3.1 MS-DOS 5.0 PFS Window Works	Microsoft Windows 3.1 MS-DOS 5.0 Choice of one application	Microsoft Windows 3.1 MS-DOS 5.0 WinRix Adobe Type Manager 2 Lotus Applications
SERVICE:				
Technical Support	Lifetime toll-free automated Technical Support 1-year ExpertHelp	Lifetime toll-free technical support	Lifetime toll-free technical support	Lifetime toll-free technical support
On-Site Service Contract Included	2nd Business Day^	2nd Business Day	YES (at their discretion)	NO
FAX Support	YES	YES	NO	NO
Bulletin Board	YES	NO	YES	YES
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CIRCLE 164 ON READER SERVICE CARD

clock doubler or a 33- or 50-MHz DX, features rather than performance make this system a buying consideration.

An extension of the standard one-year depot service warranty on parts and labor costs 10 percent of the system purchase price. On-site service from Nationwide Warranty Corp. costs $99 the first year. Technical-support calls, not toll-free, are handled weekdays during normal business hours.—*Greg Pastrick*

Axik Computer Inc.

Ace Cache 486SX-25

If you want local-bus video one day, Axik Computer's ISA-based Ace Cache 486SX-25 has a 32-bit local-bus video slot built directly onto the motherboard. This system combines good performance and excellent expandability, both for a reasonable $2,498.

The Ace Cache we tested came with 4MB of RAM, a 240MB IDE hard disk, and a 256K RAM cache. Eight SIMM sockets on the motherboard can hold a maximum 32MB of RAM. A processor cache controller, a video adapter, and an I/O card occupy three of the motherboard's eight 16-bit ISA slots. The 32-bit local-bus video slot will accept only Axik local-bus cards, which should be ready for shipment when you read this.

The upgradable motherboard, designed by Axik, lacks a vacancy socket for OverDrive upgrades but has a ZIF (zero-insertion-force) socket so upgrades are still easy for end users. The secondary cache and a Weitek coprocessor socket are right next to it and easily accessible. This mini-tower has five front-accessible bays (three 5.25-inch, two 3.5-inch); three 3.5-inch bays are internal.

The video subsystem consists of a Diamond Stealth VRAM adapter and a ViewSonic 6 14-inch monitor that has a maximum noninterlaced resolution of 1,024-by-768 and a 72-Hz refresh rate.

Performance was average on both processor and memory tests, but a Promise Technology DC-2031 disk controller with 4MB of cache helped the Quantum ProDrive LPS 120-AT hard disk achieve an above-average disk score. A Diamond Stealth VRAM card garnered the second-highest Graphics Winmark score in this roundup; as we have seen before with the S3 chip, its DOS-based video score was below average.

Axik sells through dealers and direct and offers a 13-month warranty on parts and labor; extensions are available, but on-site service is not. The toll-free technical-support line operates every day but Sunday.—*Tin Albano*

The Ace Cache 486SX-25

FACT FILE

Ace Cache 486SX-25

Axik Computer Inc., 1031 E. Duane Ave., Suite F, Sunnyvale, CA 94086; 800-234-2945, 408-735-1234; fax, 408-735-1437

List price (tested configuration): $2,498

Memory and processor RAM cache: 4MB 70-ns SIMMs, 256K cache.

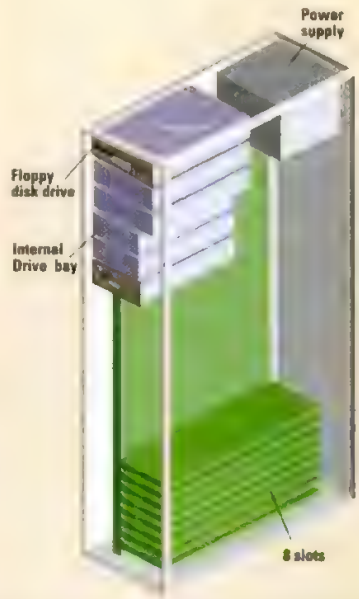
Disk drives and controller: Quantum 240MB IDE hard disk, Promise Technology controller, 4MB cache, 1.2MB and 1.44MB floppy disk drives.

Display: Diamond 1,024-by-768 adapter with 1MB RAM, ViewSonic 14-inch monitor, 72-Hz refresh rate

Software: DOS 5.0, Microsoft Windows 3.1.

In short: The Ace Cache 486SX-25, a well-built machine that allows for future expandability, offers good performance at a competitive price.

534 ON READER SERVICE CARD



Blackship Computer Systems Inc.

BLK 486SX/25

Like many of the systems reviewed here, the $2,149 BLK 486SX/25 lacks the benefits of a large memory cache, a caching disk controller, and the accelerated video the better-performing systems have. When tested against these systems, it registered below-average processor and memory scores.

The small-footprint Blackship is an eight-slot, 16-bit ISA system. Like other PCs that use the Free Technology motherboard, it can be upgraded to handle DX and DX2 clock doublers with a change of BIOS and clock crystal. The Blackship comes with 4MB of RAM and a maximum system memory of 32MB. Its 64K external cache, managed by an OPTi controller, is configured with direct-mapped, write-back memory.

The 203MB Maxtor IDE hard disk occupies one of the six available drive bays in the machine. The Blackship motherboard uses a standard CPU socket and has a Weitek socket. Its video subsystem teams a Tseng ET4000–based Orchid ProDesigner IIs adapter with a ViewSonic monitor.

The BLK 486SX/25

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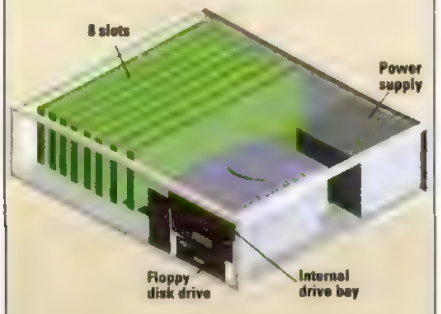
CIRCLE 021 ON READER SERVICE CARD

FACT FILE

BLK 486SX/25

Blackship Computer Systems Inc., 2031 O'Toole Ave., San Jose, CA 95131; 800-531-7447, 408-432-7500; fax, 408-432-1443

List price (tested configuration): $2,149.
Memory and processor RAM cache: 4MB 70-ns SIMMs, 64K cache
Disk drives and controller: Maxtor 15-ms 203MB IDE hard disk, MIO controller, 1.2MB and 1.44MB floppy disk drives.
Display: Orchid 1,024-by-768 adapter with 1MB RAM, ViewSonic 14-inch monitor, 60-Hz refresh rate
Software: DOS 5.0.
In short: The BLK 486SX/25 is an ordinary small-footprint PC with mediocre performance.
536 ON READER SERVICE CARD



Processor and memory scores were below-average when tested against systems with caches larger than 64K. The 15-millisecond Maxtor hard disk posted low scores consistent with the absence of a caching disk controller. DOS-based video was average; the system lacked an accelerator for Windows graphics.

Blackship Computer Systems markets the BLK 486SX/25 primarily as a general platform for a General Services Administration (GSA) contract and university applications. As configured here, the system may be appropriate for general applications, but more sophisticated applications demand a performance advantage not found here. Since the system has drive expansion room and a healthy 250-watt power supply, you can inexpensively boost its bland performance.

The one-year warranty on parts and labor includes free on-site service from GE Computer Services. No service contract extensions are available, but you can get toll-free technical support.—*GP*

Blue Star Computers Inc.

Blue Star 486SX/25 Desktop

The ISA-based Blue Star 486SX/25 Desktop costs $1,849 with 4MB of RAM and a Maxtor 213MB IDE hard disk with a 32K buffer; DOS 5.0 and Microsoft Windows 3.1 are preloaded. Blue Star Computers pairs this system's best features—a Diamond SpeedSTAR HiColor 1,024-by-768 adapter based on a Tseng ET4000AX and a Sierra HiColor RAMDAC—with a CTX 1,024-by-768 monitor that handles the 32,768-color output well. But you can probably find similar values at lower prices.

The upgradable six-layer Zenny motherboard, made in Taiwan, lacks an OverDrive socket. It came with an empty 386 socket, a 486SX in a standard socket, 64K of direct-mapped, write-back cache, and a Weitek coprocessor socket. To upgrade, pull out the 486SX; the AMI BIOS is programmable.

You can extend system memory to 64MB by adding a standard memory card, although the arrangement of the first 32MB leads to a compromise on slot length. SIMM sockets extend into slot territory; to make room for them, slots 6 and 7 are 8-bit. Two of the remaining six 16-bit slots hold the Blue Star's IDE host I/O adapter and the video card.

Phillips-head screws secure the metal case to the metal frame of this standard-size desktop. The unit has five bays. Two of its three 5.25-inch half-heights are accessible, as is one of the two 3.5-inch slimlines.

Since our testing procedure favors

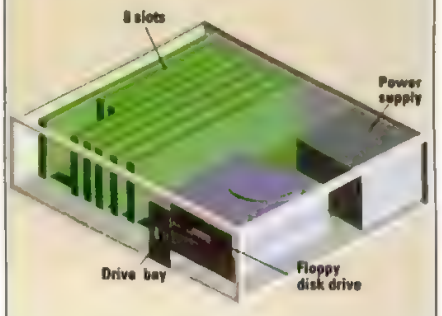
The Blue Star 486SX/25 Desktop

FACT FILE

Blue Star 486SX/25 Desktop

Blue Star Computers Inc., 2312 Central Ave. NE, Minneapolis, MN 55418; 800-950-8884, 612-788-5000; fax, 612-788-3442

List price (tested configuration): $1,849
Memory and processor RAM cache: 4MB 60-ns SIMMs, 64K cache.
Disk drives and controller: Maxtor 15-ms 213MB IDE hard disk, 32K buffer, Blue Star controller, 1.2MB and 1.44MB floppy disk drives.
Display: Diamond 1,024-by-768 adapter with 1MB RAM, CTX 14-inch monitor, 60-Hz refresh rate.
Software: DOS 5.0, Microsoft Windows 3.1.
In short: The Blue Star 486SX/25 Desktop performs solidly in terms of DOS video but is offset by an older case and motherboard design
538 ON READER SERVICE CARD



cache sizes larger than 64K, processor and memory scores were low. The disk score was on a par with those of other systems with uncached disk controllers. DOS video, about 25 percent above average, was the strongest score. For accelerated graphics under Windows, Blue Star sells a Diamond Stealth VRAM for $100 more; a 256K processor cache is $50.

Blue Star sells direct and through dealers, offering a 30-day money-back guarantee and a one-year warranty on parts and labor. On-site service from USNet is $59 the first year. Technical support is toll free 24 hours a day.
—*Ann Ovodow*

C^2 Micro Systems Inc.

C^2 Saber 4X25

The $2,785 ISA-based C^2 Saber 4X25 is a very solid machine. A sturdy case, name-brand components (a Quantum

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CIRCLE 139 ON READER SERVICE CARD

245MB hard disk, an UltraStor caching controller, a Sony monitor, and a Diamond Stealth VRAM adapter), plus DOS 5.0 and Windows 3.1 included are likely to recommend it to Windows users looking for a reliable small-footprint desktop.

Efficiently organized, the Saber is designed for upgrading. One of its eight ISA slots is occupied by the 1MB Diamond Stealth VRAM adapter; five 16-bit slots are free. The easily accessible Intel processor is mounted on a standard socket on the motherboard; a Weitek math coprocessor socket is also within reach. The 4MB of RAM, expandable to 64MB via the motherboard's four memory banks, is supplemented by a 256K cache managed by a Symphony controller. One unusual feature is that you can expand this cache to 1MB. Four bays (three 5.25-inch and one 3.5-inch) are front-accessible; two are occupied. The hard disk, aided by an UltraStor caching disk controller with 512K of RAM, is mounted on the power supply—an odd albeit handy design. The monitor is a 14-inch 1,024-by-768 Sony MicroScan 4A with a 72-Hz refresh rate.

The C² Saber 4X25

While its processor score was within the normal range, the Saber distinguished itself on our memory and disk tests—results we attribute to its zippy caching controller.

The Saber's name-brand components performed well on most of our tests. While the processor score was within the normal range of all the units tested, the Saber distinguished itself on our memory and disk tests—results that we attribute to its zippy caching controllers. Video scores were typical for the S3 chip–based adapter: low on our DOS-based video test and high on our Graphics Winmark test.

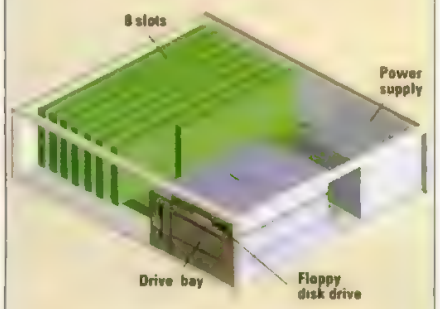
The Saber is designed to be a solid performer for Windows users—precisely what it is. Its documentation is clearly written, and its standard one-year warranty on parts and labor is supplemented by free on-site service from Nationwide Warranty Corp. Although technical support is free, the company has no toll-free line.—*Susan G. Thomas*

FACT FILE

C² Saber 4X25

C² Micro Systems Inc., 47560 Seabridge Dr., Fremont, CA 94538; 800-659-9997, 510-683-8888; fax, 510-683-8662

List price (tested configuration): $2,785
Memory and processor RAM cache: 4MB 70-ns SIMMs, 256K cache.
Disk drives and controller: Quantum 16-ms 245MB IDE hard disk, UltraStor controller, 256K cache, 1.2MB and 1.44MB floppy disk drive.
Display: Diamond 1,024-by-768 adapter with 1MB RAM, ADI 14-inch monitor, 72-Hz refresh rate
Software: DOS 5.0, Microsoft Windows 3.1.
In short: While the C² Saber 4X25 is not exactly thrilling, it is very solid. We like this system for its name-brand components, a sturdy case, and a reasonable price tag
537 ON READER SERVICE CARD



Comex Computer Corp.

Comex 486SX-25

The $2,395 Comex 486SX-25 comes with 8MB of RAM, which accounts for its slightly higher price compared with similar systems in this roundup. Its performance is competitive, however, and the Comex's construction is well suited to customization.

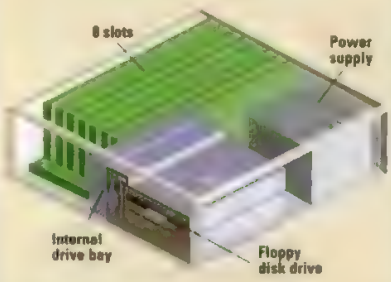
Comex Computer Corp. uses the Micronics line of motherboards to cover all possible configurations. The eight-slot ISA motherboard in our test system had both a standard socket that could accept 486DX upgrades and an OverDrive socket. You can expand the system RAM to 64MB. Although our evaluation unit came with no secondary cache, 64K and 256K cache options are available. The

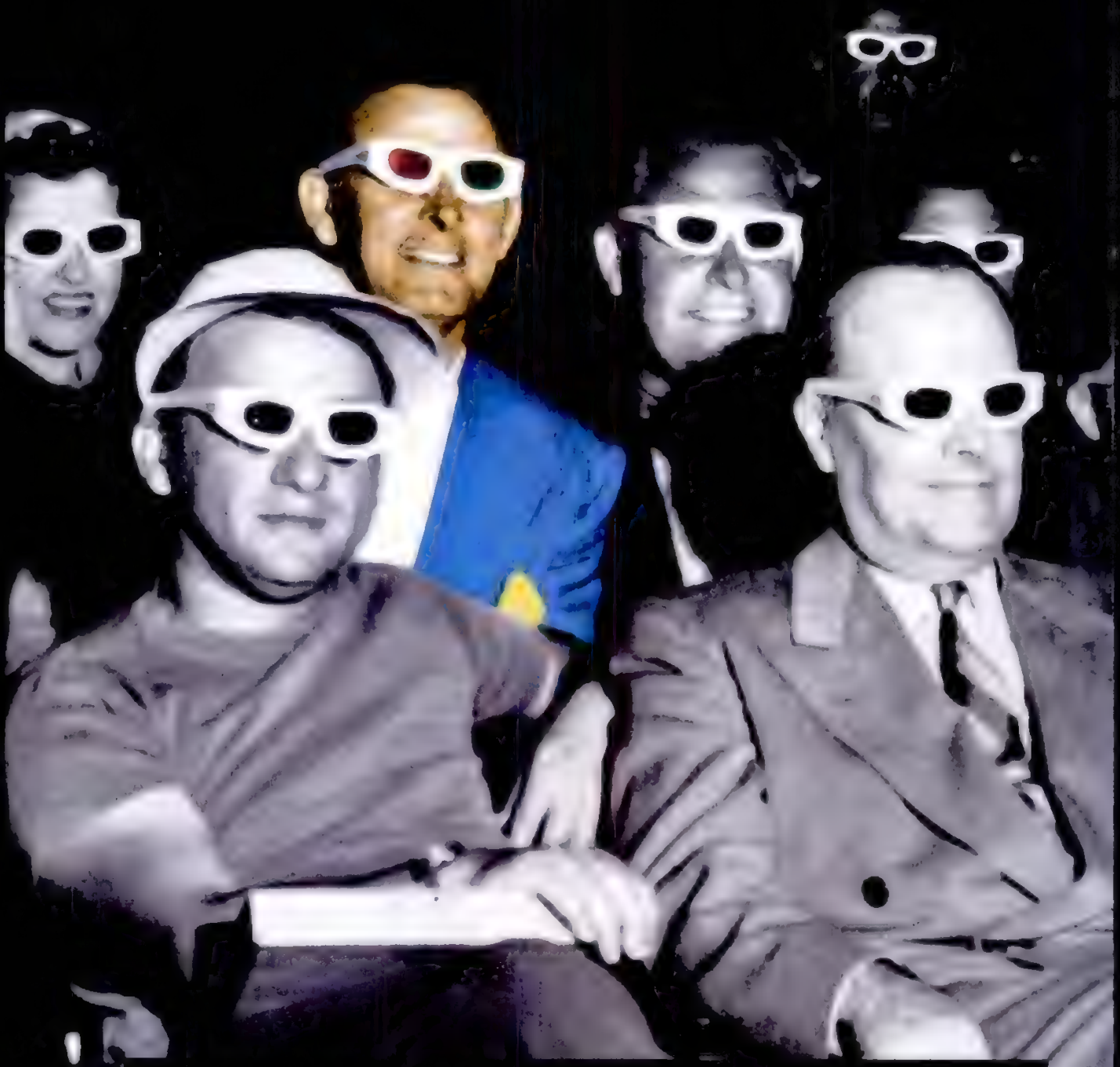
FACT FILE

Comex 486SX-25

Comex Computer Corp., 3450 S. Broadmont, Tucson, AZ 85713; 800-826-9577, 602-792-0100; fax, 602-792-9722

List price (tested configuration): $2,395
Memory and processor RAM cache: 8MB 70-ns SIMMs
Disk drives and controller: Western Digital 15-ms 212MB IDE hard disk, integrated controller without cache, 1.2MB and 1.44MB floppy disk drives.
Display: Tseng 1,024-by-768 adapter with 1MB RAM, Amazing Technologies 14-inch monitor, 60-Hz refresh rate
Software: DOS 5.0, Microsoft Windows 3.1.
In short: The Comex 486SX-25 offers more memory than most of the machines in this roundup and a good warranty, but its price and performance are very average
538 ON READER SERVICE CARD





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PC Sources, August 1992

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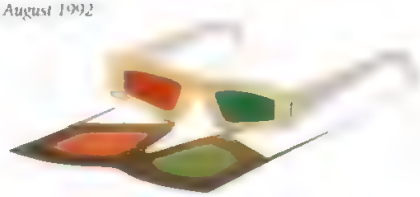

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The Comex 486SX-25

Comex had a Phoenix BIOS and a Micronics chip set.

The video display subsystem was based on a 1MB Tseng TSVGA/4000AX video adapter complemented by a 14-inch Amazing Technologies 1,024-by-768 monitor with a 60-Hz refresh rate. The IDE hard disk is a 15-millisecond 212MB Western Digital Caviar 2200. The case contains three accessible drive bays (two 5.25-inch half-heights and one 3.5-inch slimline) and two internal bays (one of each type). The drive bays, ports, and slots are easily accessible, and the 250-watt power supply is yet another favorable feature.

Its processor and memory scores were good, tying with those of other machines in these tightly bunched performance clusters. The uncached hard disk, however, turned in a low score. The Tseng chip–based adapter, geared to DOS video, produced another score just a shade higher than average within a tightly bunched range of very similar scores. It was not designed for Microsoft Windows operations.

Since Comex distributes its systems to VARs and OEMs, the unit has to be a vanilla system by design in order to serve as a platform for loading a variety of options. This is the kind of job the Micronics motherboard and chip set handle very well.

The standard warranty includes two-year coverage with extended service contracts available at $195 a year. Technical backup and questions are covered on a toll-free help line. On-site service and support is being negotiated with a third-party supplier; until it's settled, Comex is handling these duties.—*GP*

The Deskpro is easily upgradable: merely pop out the old processor, insert the new one, and run the setup utility. If that's worth a lot to you, maybe the price isn't such a hurdle.

Compaq Computer Corp.

Compaq Deskpro 486S/25M

Compaq Computer Corp. made a strong impression on us a little while ago with its 486DX2/50 EISA machine, the Compaq Deskpro 50M. The Compaq Deskpro 486S/25M uses the same case and package, but skimps on certain key features (such as the marvelous EISA QVision video board) while charging a roof-reaching $4,276. Frankly, 486 25-MHz systems are supposed to be aimed at the entry-level business desktop; for this kind of cash (and the accompanying average performance), you might as well spend a few more Ben Franklins and buy the Deskpro 50M. At least you'll get some bang for your buck.

The Deskpro 25M did give us one useful insight, however. The test unit was actually the same one we used in our earlier DX2 story (September 15, 1992). This gave us a chance to see how easily the

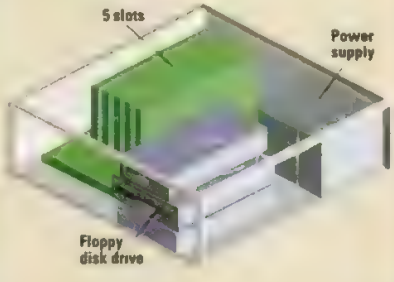
The Compaq Deskpro 486S/25M

FACT FILE

Compaq Deskpro 486S/25M
Compaq Computer Corp., 20555 State Hwy. 249, Houston, TX 77070; 800-231-0900, 713-370-0670

List price (tested configuration): $4,276
Memory and processor RAM cache: 8MB 80-ns SIMMs
Disk drives and controller: Compaq/Conner 16-ms 212MB IDE hard disk, 64K buffer, 1.2MB and 1.44MB floppy disk drives.
Display: Compaq 800-by-600 adapter with 512K RAM, Compaq 15-inch monitor, 72-Hz refresh rate
Software: Compaq utilities
In short: The Compaq Deskpro 486S/25M lacks some of the key features of the 50-MHz DX2 version, yet the two are only a few hundred dollars apart. If you want the Compaq name, you are better off with the DX2 system

539 ON READER SERVICE CARD



Deskpros allow upgrading (or downgrading, as the case may be): merely pop out the old processor unit, insert the new one, run the setup utility, and you're home free. If that's worth a lot to you, maybe the price isn't such a hurdle.

The rest of the package was the same as the Deskpro 50M, including the excellent documentation and third-party software support. Again, only four slots are left free for expansion and there is no secondary SRAM cache to back up the 8MB to 64MB of system RAM. The same Conner 212MB IDE hard disk remains integrated to the system board, though now the quality QVision board is replaced by a lower-grade Advanced VGA EISA adapter.

This last component performed nowhere near the QVision's scores, though it did manage reasonable results. Processor and memory scores were average

as well, though the cacheless Conner hard disk came in below average.

Though stories have been flying regarding Compaq's attack on high prices, this kind of performance is still mismatched with the price tag.—*OR*

Compudyne Products

Compudyne 4SX/25

The Compudyne 4SX/25 squeezes quality components, average performance, and a surprisingly decent overall package into what must be a tight-fitting price pouch: $1,499. If low price is a concern, this one merits very special attention. Though you can easily find places where Compudyne Products cut corners in order to save a few bucks, the end result is still a competitive product, even among the middle- to higher-priced systems.

The standard small-footprint desktop case, outfitted with easy-open thumbscrews, is a little cramped. It houses only three front-accessible 5.25-inch half-height drive bays (two occupied by floppy disk drives), and a single internal side-mounted 3.5-inch half-height bay that holds the hard disk. Not too much room for expansion, especially if you're thinking multimedia.

Compudyne's own AC486 motherboard has an AMI system BIOS and handles 1MB to 32MB of RAM on-board. Here again, Compudyne has sacrificed upgradability in favor of a low initial price. Though the unit is equipped with an OverDrive socket, enabling it to be upgraded to a 50-MHz 486DX2 processor, there is no secondary cache. Without it, the OverDrive chip (and to some extent the original 4SX/25) is at a per-

FACT FILE

Compudyne 4SX/25

Compudyne Products, 15151A Surveyor Rd., Addison, TX 75244; 800-932-2667, 214-702-5600; fax, 214-702-0300

List price (tested configuration): $1,499.

Memory and processor RAM cache: 4MB 70-ns SIMMs.

Disk drives and controller: Western Digital 14-ms 200MB IDE hard disk, 64K buffer, Compudyne controller, 1.2MB and 1.44MB floppy disk drives.

Display: Compudyne/IET 1,024-by-768 adapter with 1MB RAM, Compudyne 14-inch monitor, 62-Hz refresh rate.

Software: DOS 5.0, Microsoft Windows 3.1, LANtastic.

In short: A very successful stab at the low-cost market, the Compudyne 4SX/25 is worth close scrutiny if you want to pay the least and can live without performance boosters like a CPU cache.

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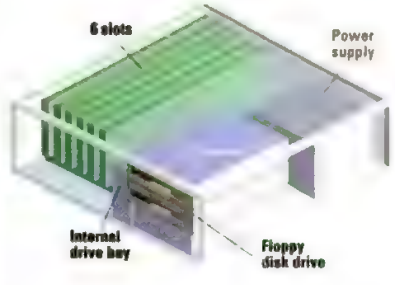


▪25-MHz 486SX PCs:

PROCESSOR AND MEMORY

Of the 58 486SX machines reviewed here, 16 did not have secondary RAM caches. Of the 42 cached PCs, half used 256K caches, 7 held 128K each, and the rest used 64K caches. Processor performance scores were tightly spaced around an average of 259 operations per second. Two machines tied for a low score of 205 operations per second: the BLK 486SX/25 and Insight 486SX-25; each used an OPTi 82C493 cache controller with a 64K secondary RAM cache. Other systems with 64K caches—those from Blue Star, NETis, Northgate, Tri-Star, and U.S. Micro Express—did not score as high, but such small caches don't fare well under the 128K No-Operation portion of PC Labs' Hardware Performance Tests.

Memory scores were also tightly grouped, with only 11 scores falling beyond the standard deviation of ±1 (514 operations per second) of the 4,423 operations-per-second mean. Four systems excelled on this test: Keydata, Polywell, Acma and Deico. Five of the seven systems that fell one standard deviation below average on our memory test used 64K cache designs. Make sure that the system you buy has a well designed cache with at least 128K if you plan to add an OverDrive chip.

All three I/O bus architectures were represented in this roundup. EISA systems were submitted by ACMA, Amax, Amkly, Compaq, Mega, Mitsuba, PCI, Spear, and Tangent—nine systems in all. The IBM PS/2 Model 95 XP 486SX/25 was joined in the MCA class by the CORE Model 95 and NCR System 3335. The remaining 46 systems used the ISA design. We tested each of the MCA-bus PCs at a 10-MHz operating frequency and the other systems (except the Myoda) at the nominal 8-MHz standard. PC Magazine Labs could not set the Myoda 486SX-25b to operate at the standard 8-MHz rating, so we set the frequency to 6.25 MHz, the closest possible value that didn't exceed the standard.

DISK

Five of the EISA-based systems also used caching disk controllers—those from ACMA, Amkly, Mega, Mitsuba, and Tangent; the CORE and IBM used MCA, and they were joined by 11 ISA systems that had disk controllers with hardware caches. With the exception of these two MCA entries, all of the systems with caching disk controllers scored among the top third of the test group on the disk test. The CORE and IBM each use SCSI controllers, and hard disks of their own proprietary design had identical scores of 150 kilobytes per second (the class average was 226 KBps). Clearly, their designs fall short of the mark. The Mitsuba Professional Upgradable, using an Alpha Research EISA-IPG with a 4MB cache, was the clear performance leader at 873 KBps, followed by the i Corp Blazer IIs, Mega Impact 486SX/25E+, ACMA 486SX/

What the Numbers Mean

25, and Axik's Ace Cache 486SX-25. These systems round out the top five and also feature 4MB cache designs. International Instrumentation's ISA-based Blue Max Monolith 486UP/25S also used a 4MB controller, the UltraStor Ultra 12, but its performance didn't match that of the top five despite its 4MB cache; it placed thirteenth. And the only other system with an ESDI hard disk, the EISA-based Amkly 486SX/25E with an UltraStor Ultra 22C controller and 512K cache, ranked seventeenth. The remainder of the field was dominated by IDE units.

VIDEO

Video performance for these systems confirmed conclusions we've drawn from previous PC Labs evaluations and shed some new light on local-bus performance and the importance of current drivers. Twenty machines featured video-adapter designs centered around the Tseng ET4000 chip, and 19 relied on the S3 video chip set design. As we've seen in the past, the Tseng design excels on our conventional DOS-based video test but falters in testing under Windows. The S3 design flip-flops those results. On our video test, ET4000-based PCs averaged 4,346 KBps, versus 1,742 KBps for S3 chip–based units; the average Graphics Winmark score for the former was 2.28 million, versus 6.34 million for the latter. As a reference, IBM's XGA implementation in the IBM made possible a score of 3,170 KBps for the video test and 3.86 million for the Winmark test, while Compaq's proprietary design in their PC fared slightly better on DOS-based video, at 3,510 KBps and Windows graphics, at 3.21 million.

Micro Express's ME 486SX/Local Bus/25 produced the best video score; this PC featured a Tseng ET4000–based local-bus design, which also turned in an extraordinarily high Winmark score for that chip set—6.38 million. Unfortunately, our enthusiasm for the Micro Express, which did reasonably well on other tests, was dampened by reliability concerns. The motherboard in the first system the company sent us failed, and then the monitor failed after we worked with the replacement system for three days. Among the top ten Winmark performers, the Ergo Moby Brick 486SX with an ATI Graphics Ultra video adapter topped the scale at 7.62 million. In fact, three other systems that used the ATI Graphics Ultra were also in that top ten—the Gateway 2000 25MHz/486SX (7.41), ACMA (7.07 million), and Lightning Omniflex 486SX25 (7.01 million). The other top-ten graphics performers were the Axik (7.53 million), C^2 Saber 4X25 (7.09 million), and Ariel 486SX/25 (7.04 million), all of which used the Diamond Stealth video adapter; the Polywell (7.33 million), which used an Orchid Fahrenheit 1280°; the Micro Generation LB-25SX (7.09 million), with a GHost S3 chip–based adapter; and the Computer Sales Professional Pro 486SX/25 (6.66 million), which featured a Western Digital WD90C31 chip.

You can see a vivid example of the impact of video drivers by comparing the Computer Sales Professional's score with that of the Compudyne 4SX/25, which used the same WD chip set and an outdated driver; the Compudyne's Winmark score was a meager 2.01 million. The lesson: Be aware of the importance of drivers, choose a manufacturer that provides regular updates and revisions, and then be sure you have the latest version.

Of the top ten video performers, those with local-bus implementations that use the Tseng ET4000 took the four top slots, with scores ranging from 9,249 KBps for Micro Express to 5,668 KBps for the DFI Diamond Series Model 425SX. All of these scores were well above both the roundup average (3,053 KBps) and the average of ET4000 scores (4,346 KBps), which validates the gains of the local-bus design. Three of the remaining six top-ten video performers used the Diamond SpeedSTAR adapter, and the other three featured either the WD90C30 or WD90C31 chips. It's worthy to note that for balanced, above-average, conventional and graphics performance, look to the WD implemented in the Compudyne, Computer Sales Professional, Dell, Softworks, and Tandy machines. Be sure you get the latest drivers if you want the best performance.

The poorest video performers on both the video and Graphics Winmark test were those using the Trident video implementation: the Amkly, Copam, and Twinhead PCs. □

formance disadvantage. Compudyne offers no cache upgrade.

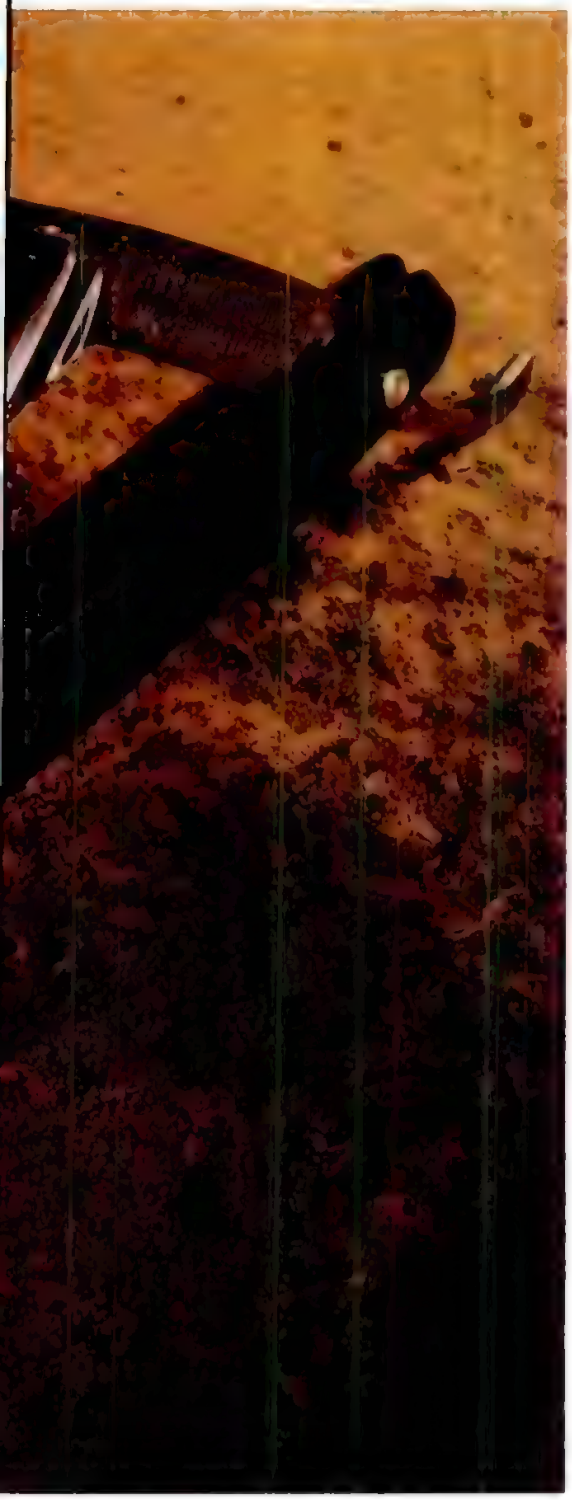
Six 16-bit ISA slots grace the system. Two are taken, one by a combination IDE pass-through connector (for the Western Digital Caviar AC2200 200MB IDE hard disk) and I/O card. Since this card lacked a cache (relying instead on the Caviar's internal 64K read-ahead buffer), it would have been better to integrate the IDE and I/O circuitry onto the motherboard, but again Compudyne seemed highly price conscious. The second slot is taken by a PVGA Compudyne/IET video adapter with a WD90C31 chip set and 1MB of video DRAM. In the end you're left with only four slots free.

Compudyne's 14-inch KD-1450 monitor is a good unit with a tilt/swivel base and front-mounted twist-knob controls. It offers 1,024-by-768 resolution, but at only a 62-Hz refresh rate. Also included in the package is a serial mouse, DOS 5.0, and Microsoft Windows 3.1.

The processor score was tied with a large number of systems that placed in the top five. The memory score, suffering the lack of an external cache, dropped significantly, however. The hard disk trooped along with the middle of the pack, and the Western Digital-designed video chip set failed to distinguish itself

WHAT ELSE ARE THEY SLASHING

WHEN THEY SLASH PRICES?



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- FastLynx
- Memory Expandable
- One Dedicated Internal Modem Slot

Super 386 SX 20

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- 60 MB Hard Drive
- VGA Supertwist Backlit CCFT (32 Gray Shade)
- DOS 5.0
- FastLynx
- Memory Expandable
- One Dedicated Internal Modem Slot

Super 386 SX 25

- 2 MB RAM
- 60 MB Hard Drive
- VGA Supertwist Backlit CCFT(32 Gray Shade)
- DOS 5.0
- FastLynx
- Memory Expandable
- One Dedicated Internal Modem Slot

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CIRCLE 275 ON READER SERVICE CARD

Benchmark Tests: 25-MHz 486SX PCs

Memory, disk, and video performance takes on a new and expanded meaning with the emergence of clock-doubling technology and Intel's OverDrive upgrade option. The RAM cache, I/O bus architecture, disk and disk controller, and video adapter are features that will remain intact when you install the OverDrive upgrade to your 486SX two or three years from now.

HOW WE TESTED

We used PC Magazine Labs' Hardware Performance Tests, Release 6.0, to measure the PC's processor, memory, disk, and video subsystem performance. Each test measures the number of operations performed or the data throughput over a period of time. We also used WINBENCH 2.5 to obtain the Graphics Winmark scores. To view the data we used to create this chart, look for GEOMEA.WK1 and GEOMEA.XLS in Library 3 of PC MagNet's Utility Forum. In all cases, a larger number means better performance.

We performed all the tests with the RAM and video cache shadowing enabled whenever possible. We report the disk performance without software disk caches.

• The **processor** test measures different aspects of the CPU's performance and its interaction with cache and main memory. The test consists of eight routines: an Instruction Mix native to the microprocessor type (386 or 486, for instance) and 128K No-Operation, Do-Nothing, Integer-Add, Integer-Multiply, Floating-Point Mix, String-Sort and -Move, and Prime-Number Sieve routines.

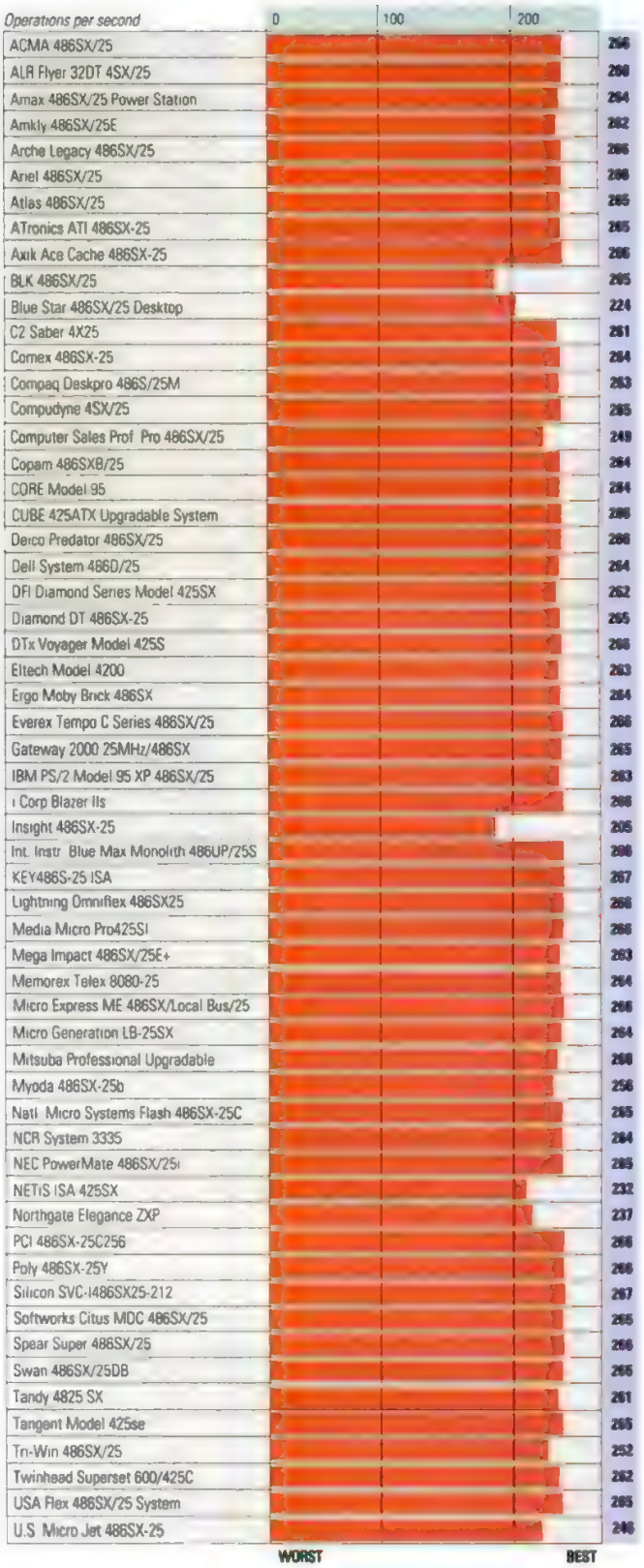
• The **memory** benchmark test measures the read/write performance of the computer's first 640K of conventional memory.

• The **disk** benchmark test evaluates the mechanical drive speed, hard disk controller functions, and bus speed, using a series of small-record (512-byte and 4K) exercises followed by similar large-record (16K and 32K) exercises. Both small- and large-record exercises include file-create, sequential write/read, and random write/read operations.

• The **video** benchmark test consists of text and graphics routines. In the Direct Screen Write routine, the video adapter's screen memory writes text to the screen. The test then performs several graphics operations, including screen fills and bit-block transfers (BitBlts).

• With the release of Version 2.5 of PC Labs' WINBENCH tests (our graphics performance tests for Microsoft Windows), PC Labs has introduced a new method of measuring graphics performance. The **Graphics Winmark** is the geometric mean of 12 WINBENCH graphics tests, measured in millions of pixels per second. PC Labs profiled the major Windows applications in November 1991 and determined which graphics functions are most frequently used within Windows. The Winmark takes into account 12 tests of these key functions and weights them to reflect how frequently the functions are used. Windows applications also use other graphics functions, but far less often.

PROCESSOR



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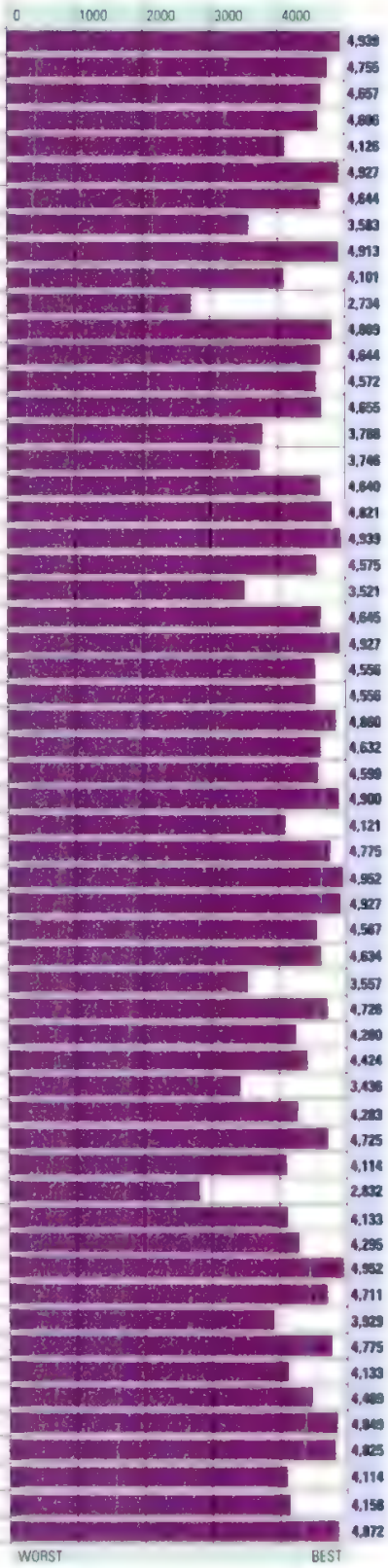

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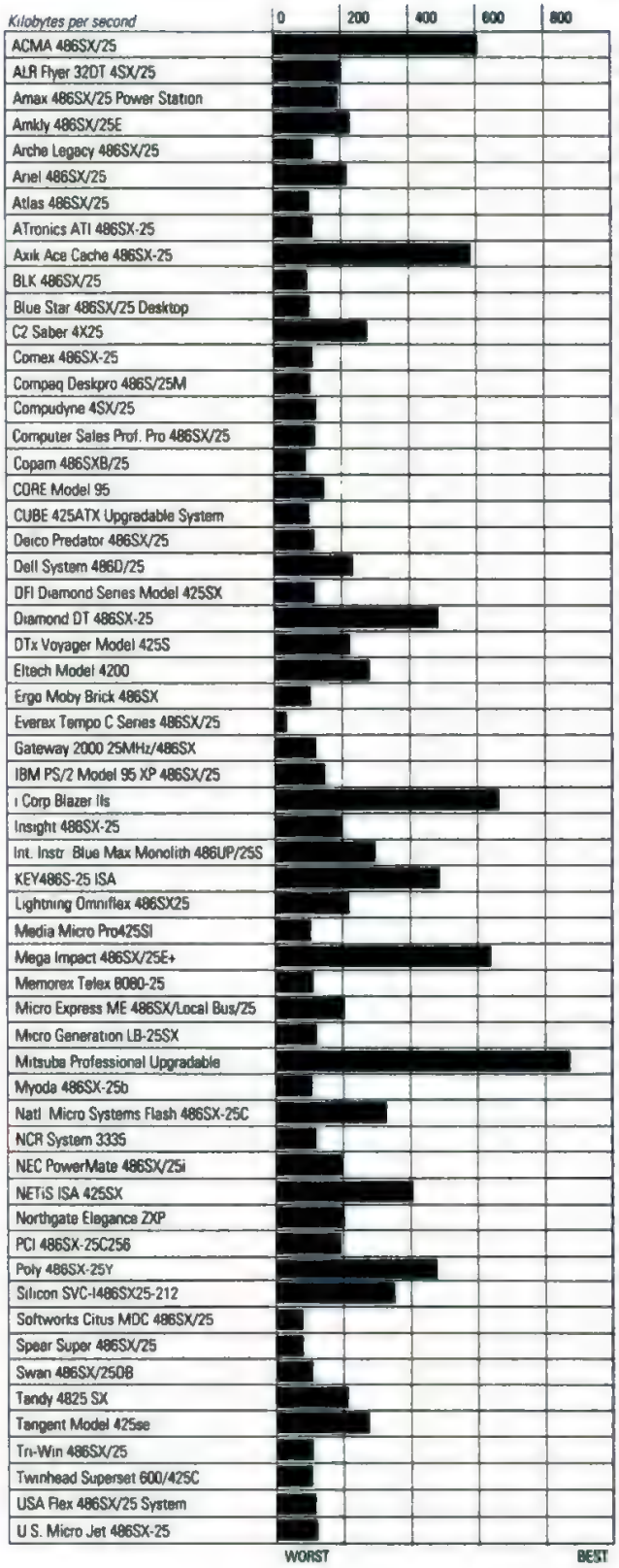

Benchmark Tests: 25-MHz 486SX PCs

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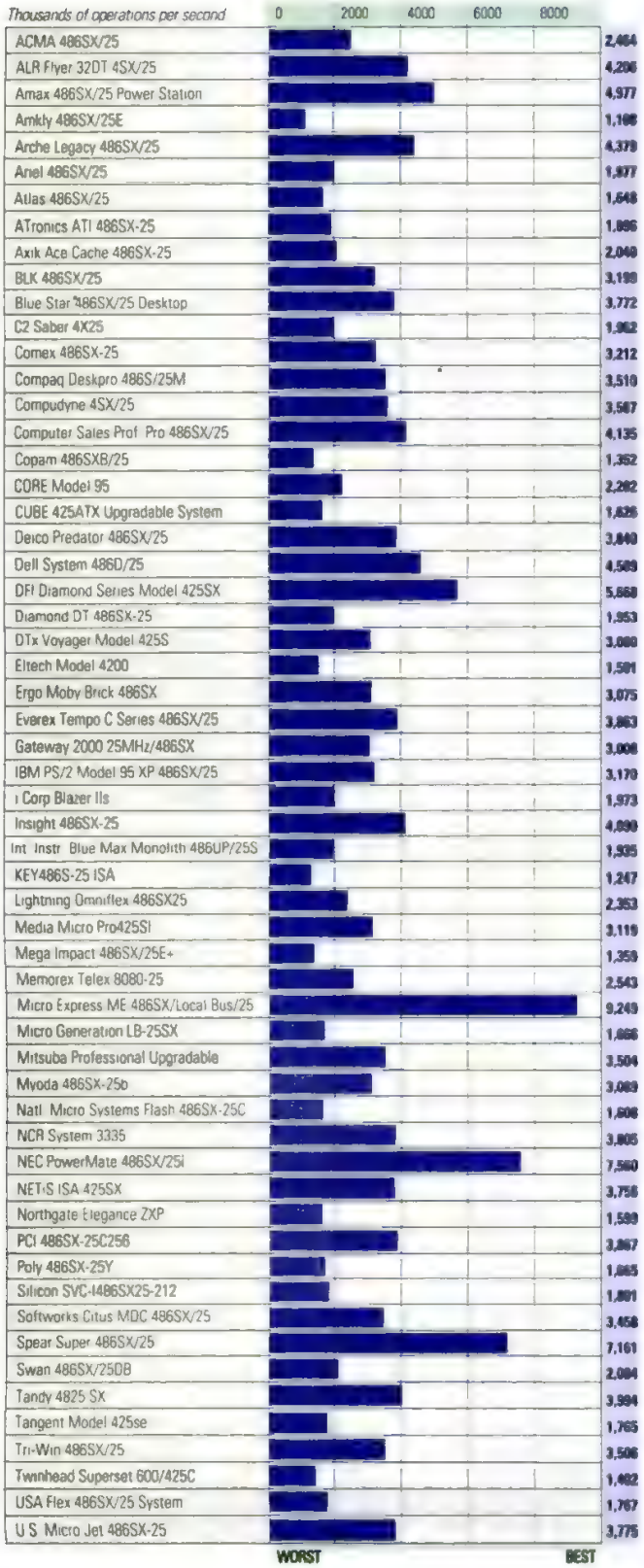
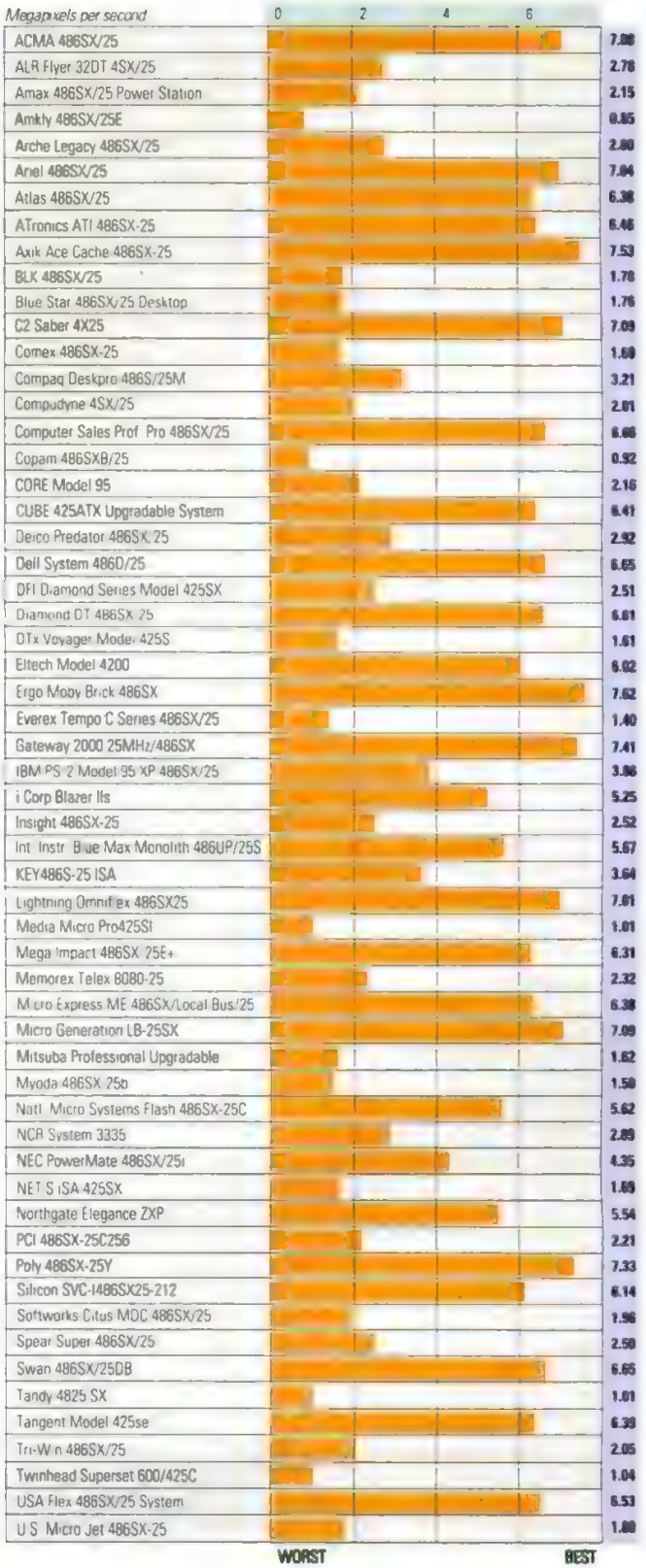
VIDEO



GRAPHICS WINMARK



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The Compudyne 4SX/25

under DOS or Microsoft Windows.

Compudyne sells this package, along with a one-year parts-and-labor warranty, direct or through certain super stores, which means that an even lower street price might be conceivable. On-site service from Dow Jones is free the first year; technical support is toll free. If you need a great price and can live without cutting-edge performance, the Compudyne 4SX/25 is hard to beat.—*OR*

Computer Sales Professional

Computer Sales Professional Pro 486SX/25

The $1,699 Computer Sales Professional Pro 486SX/25 should sell fairly well, if only for the low price.

This small-footprint ISA desktop contains five drive bays (three 5.25-inch, two 3.5-inch). Chinon floppy disk drives occupy two, and a Western Digital Caviar 2200 212MB IDE hard disk with a 64K read-ahead buffer sits in a third.

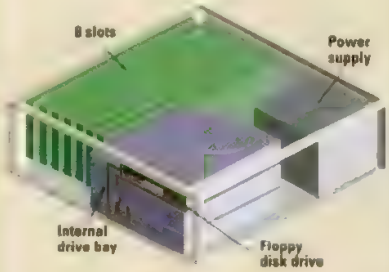
The Computer Sales Professional Pro 486SX/25

FACT FILE

Computer Sales Professional Pro 486SX/25

Computer Sales Professional, 13 Clyde Rd., Somerset, NJ 08873; 800-950-6660, 908-560-1143; fax, 908-356-5005

List price (tested configuration): $1,699.
Memory and processor RAM cache: 4MB 70-ns SIMMs, 256K cache.
Disk drives and controller: Western Digital 14-ms 212MB IDE hard disk, 64K buffer, 1.2MB and 1.44MB floppy disk drives.
Display: Western Digital 1,024-by-768 adapter with 1MB RAM, Tatung 14-inch monitor, 70-Hz refresh rate.
Software: DOS 5.0, Microsoft Windows 3.1.
In short: This PC is another no-shine, no-bombs machine with a low price. If you are thinking about making this your choice, compare it carefully against the Compudyne unit.
541 ON READER SERVICE CARD



The motherboard has an AMI system BIOS and carries between 4MB and 32MB of system RAM aided by a 256K cache. The Intel processor comes in a standard socket mounted on the motherboard and is neighbored by an OverDrive upgrade socket. Six of the eight ISA expansion slots are left free out of the factory, and slots 1 and 2 can accept only half-length cards due to the awkward positioning of some bulky motherboard components. The first card you encounter is the 16-bit DFI multifunction IDE pass-through adapter. The DFI sits in the second slot from the left and wires a COM and game port into the rear-bracket opening of the first slot. So you can't put anything into slot 1 without first rewiring your I/O ports.

The next full slot carries a 1MB Western Digital WDXLR831 video adapter, which has the WD90C31-LR video chip set. This is wired to a 14-inch Tatung CM-140AS monitor handling up to 1,024 by 768 pixels at a 70-Hz refresh rate that proved disappointing in use. System documentation for this unit offered no surprises but could have been beefed up considerably. A one-year parts-and-labor warranty with toll-free technical support also accompanies this direct-only computer.

Performance was generally average to slightly below average. Only the video card, bolstered by the new and excellent Western Digital chip set, registered above-average numbers on both our video and Graphics Winmark tests. Too bad you don't get a better monitor with which to view those graphics.—*OR*

Copam USA Inc.

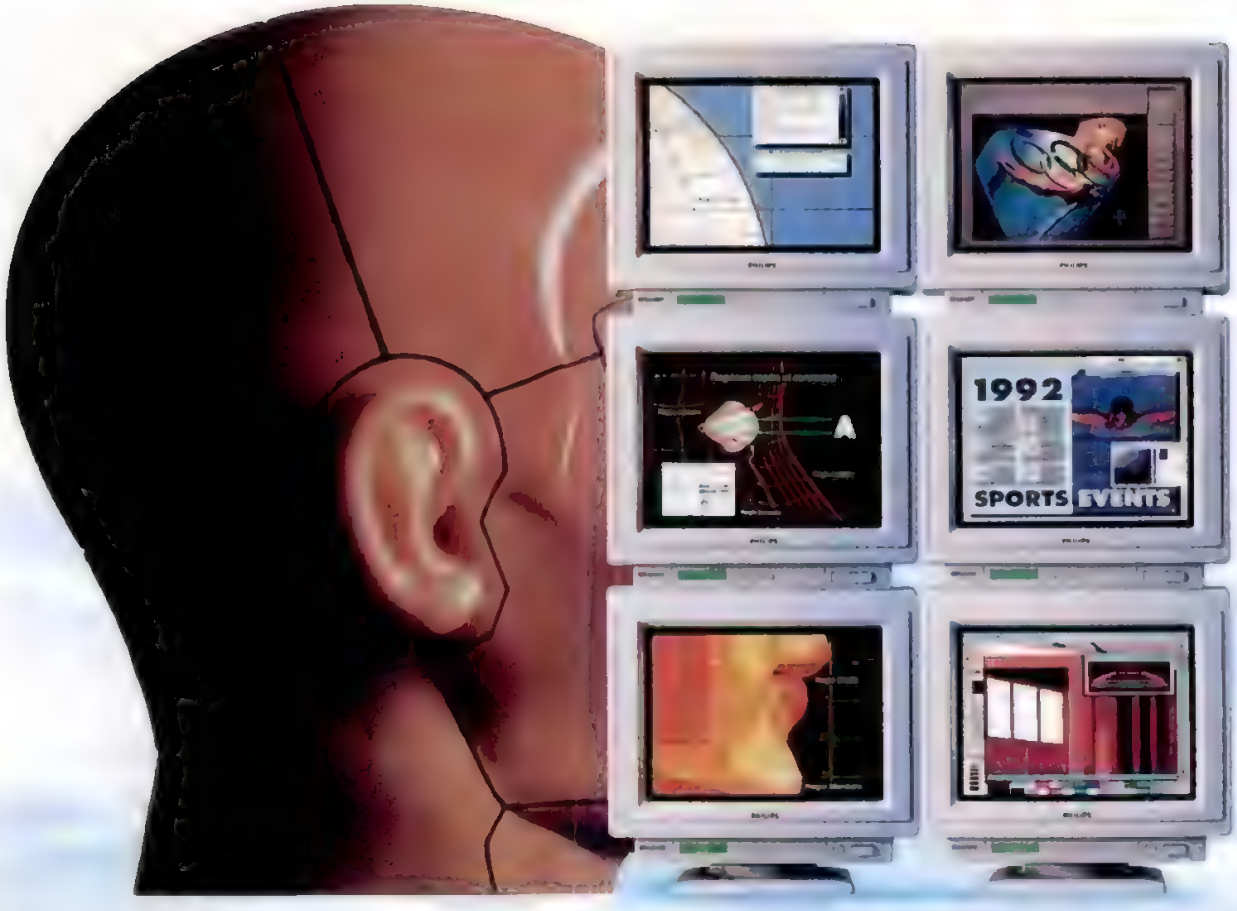
Copam 486SXB/25

The $2,999 Copam 486SXB/25 small-footprint desktop has several drawbacks: high price, slow performance, and a few design quirks.

The standard small-footprint chassis is sturdy with its cabling neatly laid out, so you can work under the cover without any trouble. Three accessible 5.25-inch drive bays grace the front of this desktop case; two hold the TEAC floppy disk drives. An internal 3.5-inch bay that houses the Seagate ST1239A 201MB IDE hard disk with a 32K buffer is located over the 160-watt power supply.

Copam USA designed its own motherboard, which uses a Phoenix BIOS, a UMC chip set, and a UMC cache controller. Expansion revolves around a vertical backplane that can accept five ISA cards. One of these is a plug-in upgrade module that fits a bit loosely in its slot and carries a 486SX in a standard socket, a Weitek socket, 1MB to 64MB of system RAM, and 256K of direct-mapped, write-back cache. Though the Copam lacks an OverDrive socket, it is upgradable via its plug-in processor module design. Video (512K RAM instead of the potential 1MB maximum) and I/O interfaces are integrated onto the motherboard—a move that would speak well for this system were it not for the slow performance.

The processor score was average, ranking sixth amid a tight performance



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CIRCLE 172 ON READER SERVICE CARD

The Copam 486SXB/25

cluster. Its memory score was below average, hampered in part by the 80-nanosecond SIMMs with two wait states; it's possible that the passive backplane coupled with the plug-in processor module slowed it even further. The Trident video chip set, which has yielded slow performance on both our video and Graphics Winmark tests before, remained true to form. Like other uncached hard disks, the Seagate finished among the slowest.

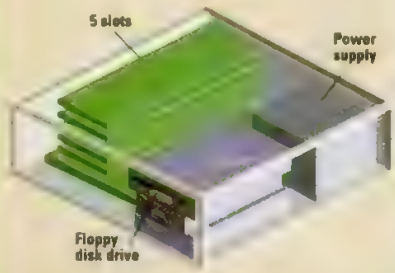
Copam offers a standard one-year warranty on parts and labor that includes free on-site service from ISC-Bunker Ramo. Technical support is toll-free.—*OR*

FACT FILE

Copam 486SXB/25

Copam USA Inc., 3333 Yale Way, Fremont, CA 94538; 800-828-4200, 510-623-8911; fax, 510-623-8881

List price (tested configuration): $2,999
Memory and processor RAM cache: 4MB 80-ns SIMMs, 256K cache
Disk drives and controller: Seagate 15-ms 210MB IDE hard disk, 32K buffer, 1.2MB and 1.44MB floppy disk drives
Display: 1,024-by-768 video with 512K RAM integrated on motherboard, 14-inch Copam monitor, 60-Hz refresh rate
Software: DOS 5.0
In short: The Copam 486SXB/25 is too high-priced for an ISA system and has no performance numbers to back it up. Keep looking.
542 ON READER SERVICE CARD



CORE International Inc.

CORE Model 95

The $12,695 CORE Model 95 has the same MCA towercase and motherboard that IBM manufactures and uses for its Model 95 series. The CORE came equipped with 8MB of RAM, a CORE 520MB SCSI-2 hard disk, a CORE SCSI-2 caching controller with 1MB of cache, and a Super VGA video adapter. By using its own disk subsystem, CORE International adds expense to the already expensive PC. Unlike most systems reviewed here, the CORE is most at home as a server, not as a workstation.

IBM's modular Micro Channel motherboard has eight 32-bit slots and one processor-module slot. The Tseng ET4000–based STB PowerGraph Ergo VGA video board occupies one of the MCA slots; CORE's SCSI-2 caching disk controller with a 1MB cache occupies another. In regard to expansion, the CORE's case has room for two floppy disk drives, three front-accessible 5.25-inch devices, and two internal 5.25-inch devices. The system uses the same processor module as the IBM PS/2 Model 95 XP 486SX/25, reviewed in this issue, and future processor upgrades can be purchased through IBM. The 486SX processor module does not have a provision for secondary RAM cache, but it does contain an OverDrive socket.

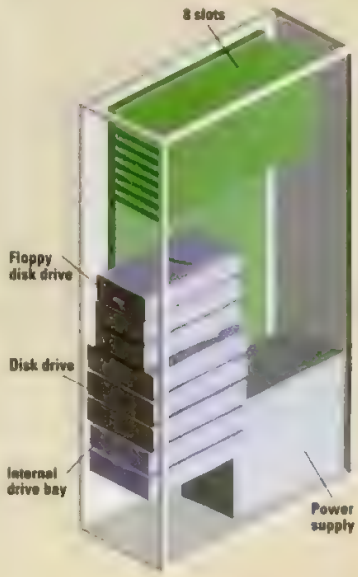
The CORE Model 95

FACT FILE

CORE Model 95

CORE International Inc., 7171 N. Federal Hwy., Boca Raton, FL 33487; 800-688-9910, 407-997-6055; fax, 407-997-6202

List price (tested configuration): $12,695
Memory and processor RAM cache: 8MB 70-ns SIMMs
Disk drives and controller: CORE 13-ms 520MB SCSI-2 hard disk, CORE controller with 1MB cache, 1.44MB floppy disk drive.
Display: STB 1,024-by-768 adapter with 512K RAM, monitor not provided.
Software: DOS 5.0
In short: CORE International's changes to the IBM PS/2 Model 95 serve only to add expense without helping performance. This is primarily a server PC.
543 ON READER SERVICE CARD



The CORE shipped to PC Magazine Labs for testing did not come with Microsoft Windows 3.1 drivers. In order for this PC to run our Graphics Winmark test, we had to download the appropriate drivers from STB's bulletin board.

The CORE yielded average processor and memory scores. In regard to its disk, video, and Winmark performance, however, the CORE yielded below-average results.

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CIRCLE 371 ON READER SERVICE CARD

The company sells its systems through resellers. The level of service is dependent upon the reseller; however, technical support can be received through IBM. CORE provides a five-year warranty on its hard disks.—*William Bettini*

CUBE Computer Corp.

CUBE 425ATX Upgradable System

Priced at $2,995, the CUBE 425ATX Upgradable System is a very small and compact mini-tower. But don't expect special tricks: Its 203MB Conner hard disk has no caching controller, and its monitor does not equal those sent with the other tested systems.

The bay chassis is easy to remove. Two 5.25-inch and two slimline 3.5-inch accessible bays hold floppy disk drives. An S3–based Orchid Fahrenheit 1280 video adapter fills one of the eight ISA expansion slots; the rest are empty. An Intel processor in a standard socket and a Symphony math coprocessor are located on the motherboard just behind the drive bays. The SIMM sockets lie between the expansion slots and the power supply; you can increase memory to 64MB. The monitor, a 1,024-by-768 noninterlaced Sony Multiscan HG, is small at 14 inches diagonally and has a refresh rate of only 60 Hz.

The CUBE arrived with its internal cache disabled and the CMOS improperly set, and the manual was fairly sloppy. Once set aright, however, the CUBE did very well on our memory and processor tests, thanks to its 128K direct-mapped external RAM cache and the Symphony math coprocessor. The PC performed well on our Graphics Winmark test and not so well on our video test—typical for the S3 chip. Its disk score was on a par with units with no caching controller.

If you absolutely crave a 13-inch mini-tower, the CUBE is what you want: well organized and easily upgradable. It is covered by a standard one-year warranty on parts and labor; on-site service from Federal Express Technology Services is $50 the first year. A toll-free technical-support line operates weekdays from 9:00 to 8:00 eastern time; a fax-back service is being planned.—*SGT*

The CUBE 425ATX Upgradable System

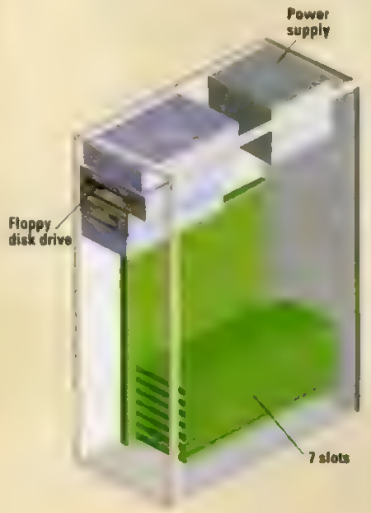
FACT FILE

CUBE 425ATX Upgradable System

CUBE Computer Corp., 150 Clearbrook Rd., Elmsford, NY 10523; 800-522-2823, 914-592-8282; fax, 914-592-3482

List price (tested configuration): $2,995
Memory and processor RAM cache: 8MB 60-ns SIMMs, 128K cache.
Disk drives and controller: Conner 16-ms 212MB IDE hard disk, 1.2MB and 1.44MB floppy disk drives.
Display: Orchid 1,024-by-768 adapter with 1MB RAM, Sony 14-inch monitor, 60-Hz refresh rate.
Software: DOS 5.0, Microsoft Windows 3.1.
In short: If you absolutely need a 13-inch mini-tower, the CUBE 425ATX Upgradable System is probably your best option. Its hard disk, however, has no caching controller, and its monitor is small.

544 ON READER SERVICE CARD



Deico Electronics Inc.

Deico Predator 486SX/25

The Deico Predator 486SX/25's most enticing feature is the broad upgrade potential of its American-made motherboard, which handles up to 12 different microprocessors plugged into a special adapter. And with its $1,995 price, the Predator deserves attention.

This small-footprint, seven-slot ISA PC comes with 4MB of RAM (expandable to 64MB) and a 256K four-way set-associative cache with posted writes. Its five accessible drive bays accept two slimline units and three standard half-height drives. The 1,024-by-768 display subsystem is controlled by a 16-bit Boca Research card with an NCR chip set, and its ViewSonic 6E monitor is known for its good color and clarity.

The Predator's incorporated 486 burst mode and 256K cache posted average results on our processor and memory tests. Even without the aid of a cache, its Western Digital Caviar 200MB IDE hard disk performed better than average on our disk test. The Boca Research card did well on our video test and average on the Graphics Winmark test without the aid of an accelerator or a coprocessor.

The real value of the Predator is in the upgrade possibilities supported by its 16-bit ISA motherboard construction and engineering. This board can handle the all-out list of DX, DX2, and SX processors in the 386/486 production line; an oscillator chip supports all clock speeds from 20 to 50 MHz as well. By the time you read this, a ZIF (zero-insertion-

The Deico Predator 486SX/25

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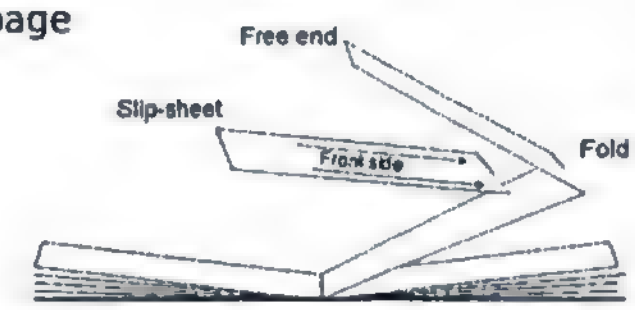

Inverted Foldout slip-sheet

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- 1.2MB 5.25" Drive
- 1.44MB 3.5" Drive
- Flash BIOS
- 8 Open Expansion Slots (7 ISA and 1 Local Bus)
- Small Footprint Chassis, 6 Drive Bays
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Circle 155 on reader service card.

FACT FILE

Deico Predator 486SX/25

Deico Electronics Inc., 2800 Bayview Dr., Fremont, CA 94538; 800-321-8990, 510-651-7800; fax, 510-651-6109

List price (tested configuration): $1,995

Memory and processor RAM cache: 4MB 70-ns SIMMs, 256K cache.

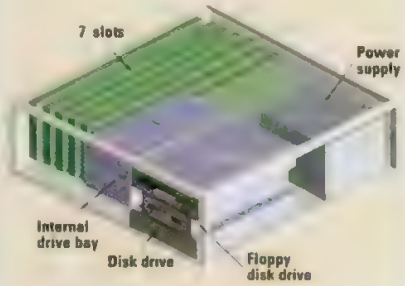
Disk drives and controller: Western Digital 14-ms 200MB IDE hard disk, 1.2MB and 1.44MB floppy disk drives

Display: Boca Research 1,024-by-768 adapter with 1MB RAM, ViewSonic 14-inch monitor, 60-Hz refresh rate

Software: DOS 5.0, Microsoft Windows 3.1.

In short: Buy the Deico Predator 486SX/25 for its broad upgrade potential, good motherboard, and under-$2,000 price.

545 ON READER SERVICE CARD



force) socket and integration of local-bus technology should be available as well.

Not surprisingly, Deico Electronics warranties the Predator motherboard for two years and all other components for one. Contract extensions are variable and competitive; fast response and 24-hour turnarounds on covered service are guaranteed. On-site service from Integrated Automation costs $75 the first year. Toll-free technical support is available weekdays during business hours; 24-hour 365-day support is an option.—*GP*

Dell Computer Corp.

Dell System 486D/25

Sweet. That's our one-word summation of the $2,819 Dell System 486D/25. With above-average components thoughtfully assembled and packed inside an extremely full-featured desktop case, this PC is well worth its price tag.

Opening the no-tools thumbscrew case feels a little like unwrapping a big Christmas gift. Inside you will find a neatly organized ISA motherboard and three accessible drive bays (one taken up by a combination 3.5- and 5.25-inch floppy disk drive). An internal 3.5-inch half-height side-mounted bay holds the 245MB Quantum ProDrive IDE hard disk and its famous 256K cache.

Dell's proprietary motherboard is everything it's meant to be, but it has one design flaw: It lacks an OverDrive socket. For an OverDrive upgrade, you will have to remove the original processor. Using a Phoenix BIOS, the system is fully and neatly integrated. A highly competitive video solution, controllers for the IDE hard disk and floppy disk drive, a full array of I/O ports, a keyboard, and even a PS/2-style mouse connector seem to have been placed on the system board by Felix Unger's technical twin. The processor, equipped with a heat sink, rests near the SIMM banks, which are wonderfully accessible and don't block any of the six free 16-bit expansion slots. Our only complaint concerned the location of the system configuration jumpers. Located beneath the power supply, they can be reached only through a 1.5- by 3-inch slot in the chassis; you'll need tweezers to change them.

This system has lots of noteworthy details. For instance, there is the easy-to-use hardware password protection, and the on-board video requires no jumper to disable: Simply slide in a new graphics card to disable the integrated video automatically. The documentation is truly superb, rivaling the quality of Hewlett-Packard's printer manuals. And Dell's UltraScan 14C monitor (apparently an OEM from Sampo) features controls that are up front and an entirely acceptable picture quality (at 1,024-by-768 at 70 Hz).

The Dell System 486D/25

Performance was nicely above average, as you would expect from a machine this well designed. Even though it lacked a secondary SRAM cache, the Dell's processor and memory scores were competitive. The Quantum ProDrive's internal 256K read/write buffer yielded a respectable score, as did its Western Digital WD90C30–based video subsystem, whose Graphics Winmark score was excellent.

Dell backs its system with a one-year parts-and-labor warranty (with free on-site service for the first year) and toll-free technical support. All this quality at such a competitive price is something you can't ignore.—*OR*

FACT FILE

Dell System 486D/25

Dell Computer Corp., 9505 Arboretum Blvd., Austin, TX 78759-7299; 800-289-3355, 512-338-4400; fax, 512-338-8700

List price (tested configuration): $2,819.

Memory and processor RAM cache: 8MB 80-ns SIMMs

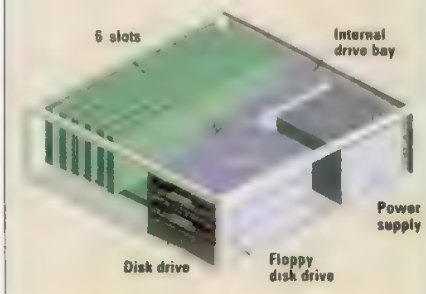
Disk drives and controller: Quantum 16-ms 245MB IDE hard disk, 256K cache, 1.2MB and 1.44MB combination floppy disk drive

Display: 1,024-by-768 video with 512K RAM integrated on motherboard, Dell 14-inch monitor, 70-Hz refresh rate

Software: DOS 5.0, Windows 3.1.

In short: Although a bit expensive for an ISA PC, the Dell System 486D/25 is still a good machine. A clean design, a pristine integrated interior, and solid performance reflect quality workmanship marred only by the lack of an OverDrive socket

546 ON READER SERVICE CARD



DFI Inc.

DFI Diamond Series Model 425SX

Long known as an OEM for other companies, DFI has introduced its own line of computers, the DFI Diamond Series. We saw one of the first models, the DFI Diamond Series Model 425SX. Its $1,995 price included 4MB of RAM, a 212MB hard disk, DOS 5.0, and Microsoft Windows 3.1. The unit scored well on our performance tests; with some minor adjustments, it would make a good Windows machine.

This small-footprint ISA desktop PC is thoroughly modular. Both the CPU and local-bus video share space on DFI's PUMA (processor-upgradable microcomputer architecture) DBV-425 card, a proprietary 32-bit adapter that has a 486SX in a standard socket, an Intel OverDrive socket, and a Tseng ET4000AX chip set. These units now ship with a 256K direct-mapped write-back cache, though our review model, which was among the first few off the production line, had only 64K (DFI assures us that 256K upgrades were later shipped to customers who bought these first PCs).

A 16MB memory card fills another 32-bit slot, adding to the motherboard's 48MB maximum. The larger slots consist of two 32-bit and four 16-bit (one of which holds a multi-I/O card); slots 6 and 7 are 8-bit to allow room for the SIMM banks. Four drive bays, one of which is internal and houses the Western Digital hard disk, complement the interior.

Although caches as small as 64K often don't score well on our test, the DFI's processor performance was good, ranking eighth in a close-performance cluster. Its memory and disk performance were slow, but the system shone when it came to our DOS-based video test, scoring well above average and ranking fourth. Since the Tseng ET4000AX chip is not designed for Windows graphics, the DFI's score on our Graphics Winmark test was low.

The DFI did have a few problems, which made us think twice about giving it a warm recommendation. Our test unit refused to recognize its own B: drive. Regrettably, its ADI 3E monitor was virtually unusable: The picture was fuzzy, and we could not adjust the contrast without affecting the background brightness.

DFI offers a one-year parts-and-labor warranty, with on-site service from AT&T. The toll-free help line, staffed by specially trained technicians, takes calls weekdays only, although a message line is available on weekends.—*AG*

The DFI Diamond Series Model 425SX

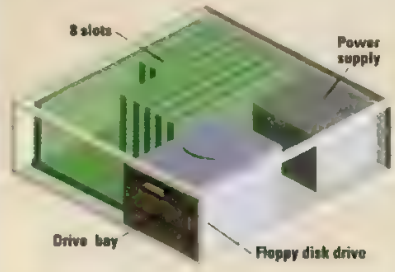
▶ FACT FILE

DFI Diamond Series Model 425SX

DFI Inc., 135 Main Ave., Sacramento, CA 95838; 916-568-1234; fax, 916-568-1233

List price (tested configuration): $1,995.
Memory and processor RAM cache: 4MB 70-ns SIMMs, 64K cache.
Disk drives and controller: Western Digital 15-ms 212MB IDE hard disk, DFI controller, 64K cache, 1.2MB and 1.44MB floppy disk drives.
Display: DFI 1,024-by-768 local-bus adapter with 1MB RAM, ADI 14-inch monitor, 60-Hz refresh rate.
Software: DOS 5.0, Microsoft Windows 3.1, BitPaint, Version 1.2.
In short: An average system with above-average video performance, this DFI computer would be a bargain if its monitor were not critically poor.

847 ON READER SERVICE CARD



Diamond Technologies Inc.

DT 486SX-25

Basically, Diamond Technologies' $1,795 DT 486SX-25 is an ISA-based solution aimed at the very price-conscious. However, there are lower-priced and better-designed systems to be found.

The small-footprint case holds five accessible drive bays: three 5.25-inch half-height and two vertical 3.5-inch (one full and one slimline). Both the power switch and keyboard connector are on the rear of the machine.

Inside, the first thing you will notice is the messy cabling. Although the S&A Laboratory IT486SQ motherboard has a PGA upgrade socket and multiple clock crystals, its 1MB to 32MB of system RAM cannot be backed up by a secondary cache—a concession to low price but a drawback if you're considering using an OverDrive chip.

The speedy Diamond Computer Technologies' Diamond Stealth VRAM adapter can pump out resolutions up to 1,024-by-768 with 256 simultaneous colors and can even handle 1,280-by-960 resolution with 16 colors. (The two Diamond companies are unrelated.) Yet the CTX 5468A monitor, obviously chosen to reduce the system cost, can only display resolutions up to 800-by-600 pixels at a trembling 60-Hz refresh rate. Spending the $50 more that it takes to order a CTX NI 5468 monitor with 1,024-by-768 at 70 Hz is a very sensible move.

What really shines, however, is the above-average hard disk. The 213MB Maxtor LTX213A drive has a 64K cache

The DT 486SX-25

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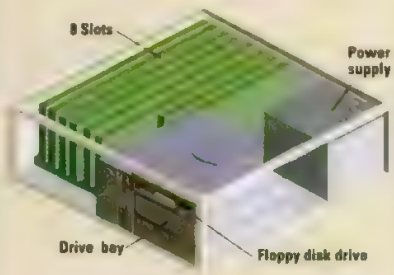
FACT FILE

DT 486SX-25

Diamond Technologies Inc., 17165 Gillette Ave., Irvine, CA 92714; 800-989-7253, 714-252-1008; fax, 714-252-1508

List price (tested configuration): $1,795
Memory and processor RAM cache: 4MB 70-ns SIMMs
Disk drives and controller: Maxtor 15-ms 213MB IDE hard disk, 64K buffer, SuperIDE controller with 2.5MB cache, 1.2MB and 1.44MB floppy disk drives.
Display: Diamond 1,024-by-768 adapter with 1MB RAM, CTX 14-inch monitor, 60-Hz refresh rate
Software: DOS 5.0, Microsoft Windows 3.1.
In short: An average computer aimed at the price-conscious crowd. Unfortunately, there are better performers out there for less.

548 ON READER SERVICE CARD



buffer and is linked to a Super IDE controller that has a 2.5MB cache (expandable to 8.5MB). Unfortunately, the caching hard disk controller and the video adapter eat up two of the six 16-bit expansion slots. The I/O ports, growing out of a nigh-obsolete 8-bit port card, fill one of the two 8-bit slots. This configuration leaves five 16-bit slots empty.

Performance was a little disappointing, since it was obvious that the addition of a processor RAM cache could have boosted the CPU and memory scores out of the average range. The S3–based Diamond Stealth VRAM, designed for Windows graphics, produced a good Graphics Winmark score but was typically slow on our DOS-based video test.

Diamond sells direct and warranties its systems for 15 months (the hard disk and floppy disk drives are covered for one year). On-site service from GE Computer Service costs $75 the first year. Toll-free technical support is available weekdays during business hours.—*OR*

Digital Technology Exchange

DTx Voyager Model 425S

At $2,795, Digital Technology Exhange's DTx Voyager Model 425S costs more than many of the systems reviewed here, and the range of expansion options can easily lift the system price beyond $3,000. While this is true of most direct-mail machines, the Voyager offers some clear performance advantages that make it a distinct choice, even with its small cache.

The Voyager comes with 4MB of RAM and a 245MB Quantum LPS IDE hard disk. RAM can be expanded to a maximum of 32MB on the eight-slot, 16-bit ISA motherboard; the 64K secondary cache is configured with direct-mapped, write-back memory. Upgrade options for the AMI Super Voyager motherboard include 33- and 50-MHz 486DX chips, and there is also a socket for an OverDrive chip. For video, the Tseng ET4000AX–based Orchid ProDesigner IIs card is matched with a quality 1,024-by-768 Optiquest 2000D display. The standard small-footprint chassis supports five accessible drive bays (three 5.25-inch half-heights and two 3.5-inch slimlines). With seven slots and two drive bays empty, our test unit had plenty of expansion room.

Breaking the pattern established by other reviewed systems with small secondary caches, the Voyager performed well on our processor and memory tests. These results, attributable to the good design of the motherboard's discrete components and proprietary cache controller, are found in other systems using the AMI Series 50 Super Voyager mother-

The DTx Voyager Model 425S

FACT FILE

DTx Voyager Model 425S

Digital Technology Exchange, 700 S. John Rodes Blvd., Melbourne, FL 32904; 407-728-0172; fax, 407-722-2216

List price (tested configuration): $2,795
Memory and processor RAM cache: 4MB 70-ns SIMMs, 64K cache
Disk drives and controller: Quantum 16-ms 245MB IDE hard disk, 1.2MB and 1.44MB floppy disk drives.
Display: Orchid 1,024-by-768 adapter with 1MB RAM, Optiquest 14-inch monitor, 70-Hz refresh rate
Software: DOS 5.0, Microsoft Windows 3.1.
In short: The DTx Voyager Model 425S performs better than expected for a system with a small processor cache. It has good expansion. Its price is a bit higher than average

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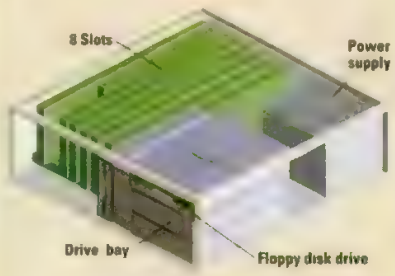

board. The 245MB Quantum ProDrive LPS 240-AT owes its above-average performance to its 256K disk cache. But the Orchid ProDesigner IIs, designed for DOS rather than Windows graphics, scored average on our video test and below average on our Graphics Winmark test.

A standard one-year warranty backs the Voyager, and a year's worth of extended coverage costs 10 percent of the initial purchase price. No third-party on-site service is available, but the company can dispatch technicians from either of its two U.S. offices. Technical support is toll-free.—*GP*

Eltech Research Inc.

Eltech Model 4200

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CIRCLE 304 ON READER SERVICE CARD

components into the Model 4200 to give it a competitive standing. The unit turned in solid performances on all of our tests except the DOS-based video test, which its S3 chip–accelerated board was not designed to handle.

Eltech puts its own eight-slot, 16-bit ISA motherboard into its small-footprint Model 4200. The upgradable six-layer motherboard carries a 486SX chip in a standard socket, as well as a 487 coprocessor/OverDrive socket. Housekeeping chores are handled by an AMI BIOS and a Symphony chip set. The unit comes with 4MB of RAM (expandable to 64MB), but like many low-end systems, it cannot accept a secondary cache.

Despite the lack of a RAM cache, the Model 4200's processor and memory scores were a shade above average. Better work was done by the 15-millisecond 202MB ALPS hard disk: Boosted by a Promise Technology IDE caching disk controller with 512K of RAM (expandable to 16MB), it yielded an above-average disk score. The Graphics Winmark score was also well above average.

The Eltech Model 4200

The Ergo Moby Brick 486SX

The S3 chip–based Diamond Stealth VRAM HiColor adapter displays 32,768 colors at 800-by-600 resolution, though the number shrinks to 256 at its 1,024-by-768 maximum. Complementing the video board is a 14-inch Arche Technology monitor that offers 1,024-by-768 resolution, but at a 60-Hz refresh rate.

The small-footprint Model 4200 has five accessible bays: three 5.25-inch half-heights and two 3.5-inch slimlines. Although in general it is well constructed, access to memory banks 2 and 3 is blocked by an adjacent vertical slimline bay. Three of the eight motherboard slots were filled: One 8-bit slot held an I/O card; two 16-bit slots held the video adapter and the combination controller for the hard disk and floppy disk drive.

Eltech's one-year parts-and-labor warranty may be extended by six months ($69), two years ($279), or three years ($479). On-site service from TRW is free for the length of the warranty. Toll-free technical support is available Mondays through Saturdays from 8:30 to 5:30 Pacific time.—*GP*

▶ FACT FILE

Eltech Model 4200

Eltech Research Inc., 47266 Benicia St., Fremont, CA 94538; 800-358-8330, 510-438-0990; fax, 510-438-0663

List price (tested configuration): $1,699

Memory and processor RAM cache: 4MB 70-ns SIMMs

Disk drives and controller: ALPS 15-ms 202MB IDE hard disk, Promise Technology controller, 512K cache, 1.2MB and 1.44MB floppy disk drives.

Display: Diamond 1,024-by-768 adapter with 1MB RAM, Arche 14-inch monitor, 60-Hz refresh rate.

Software: DOS 5.0, Microsoft Windows 3.1, Microsoft Works for Windows

In short: Decent pricing and sound performance mark the Eltech Model 4200 as a bargain.

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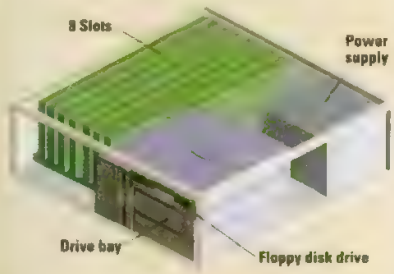

Ergo Computing Inc.

Ergo Moby Brick 486SX

The $3,995 Ergo Moby Brick 486SX has an interesting design that integrates many features within a case the size of a large brick. Our test unit came with 4MB of RAM, a 16-millisecond 213MB Conner CP3204F hard disk, DOS 5.0, and Microsoft Windows 3.1. The Moby Brick is clearly unique, but this expensive transportable PC is practical only for buyers who need the portability and power of an 8.6-pound 486SX.

The black case measures 3 by 11 by 8 inches and contains two empty ISA expansion slots—one 8-bit and one 16-bit. Packed inside is the Conner IDE hard disk with its 64K buffer; an ATI Graphics Ultra video implementation with a Mach 8 graphics accelerator is integrated directly onto the motherboard. These solid-performance components are bundled with an excellent MAG 15h multiscanning monitor that gives clear, crisp resolution up to 1,280-by-1,024 noninterlaced at a 60-Hz refresh rate. Where the Moby Brick falls short is in its lack of an OverDrive socket for future performance enhancement.

Despite the lack of a secondary cache, the Moby Brick produced processor and memory scores that fell solidly within the average range, placing sixth and thirty-first, respectively, amid tight performance clusters. Disk speed was the only area in which it fell below average. But the biggest surprise was its stunning Graphics Winmark score: The Ergo took first place.

The Moby Brick was constructed and designed to be rugged, but because of its tight confines, it's best to have the dealer install any expansion cards. A docking terminal for the PC duplicates the motherboard connections, then adds SCSI and Ethernet interfaces with network support for NetWare, Novell's ODI and NDIS, 3Com's 3+Open, LAN Manager, VINES, FTP TCP/IP, and SCO UNIX. The company also includes flash memory that supports hard disk caching by allocating system memory to that end.

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FACT FILE

Ergo Moby Brick 486SX

Ergo Computing Inc., One Intercontinental Way, Peabody, MA 01960; 800-633-1925, 508-535-7510; fax, 508-535-7512

List Price (Tested Configuration): $3,995.

Memory and processor RAM cache: 4MB 80-ns SIPPs.

Disk drives and controllers: Conner 16-ms 213MB IDE hard disk, 1.44MB floppy disk drive.

Display: 1,280-by-1,024 video integrated on motherboard with 1MB RAM, MAG 15-inch monitor, 60-Hz refresh rate.

Software: DOS 5.0, Microsoft Windows 3.1, DESQview 386, SuperStor.

In short: The Ergo Moby Brick 486SX is excellently engineered and comes in a brick-like case. It is also a reasonable performer. If you need this kind of portability and can pay the hefty price, buy the Ergo; it's the only one of its kind.

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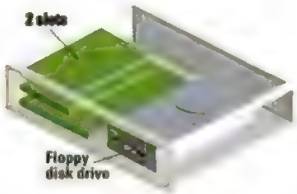


The Moby Brick has a standard one-year parts-and-labor warranty; on-site service is not an option. If the Moby Brick breaks, Ergo will fix it at its own site and will pay for shipping one way. Toll-free technical support is available weekdays from 8:00 A.M. to 8:00 P.M. eastern time.—*Mario R. Baldasserini*

Everex Systems Inc.

Everex Tempo C Series 486SX/25

Everex Systems packs 4MB of RAM and a Seagate 211MB IDE hard disk into the sleek slimline case of its Everex Tempo C Series 486SX/25; DOS 5.0 and Microsoft Windows 3.1 are also included. Since performance is competitive, the main hurdle is the $3,617 price.

Two of the Tempo's three 3.5-inch bays are accessible. Because of its small size, the unit has only one floppy disk drive. Inside, the motherboard anchors

The Everex Tempo C Series 486SX/25

three empty 16-bit ISA slots in a vertical backplane design. Maximum RAM is 32MB. A plug-in module holds the 486SX, as well as a math coprocessor socket and OverDrive socket. The Tseng-based video adapter is integrated onto the motherboard.

The Tempo's processor and memory

FACT FILE

Everex Tempo C Series 486SX/25

Everex Systems Inc., 48431 Milmont Dr., Fremont, CA 94538; 800-821-0806, 510-498-1111

List price (tested configuration): $3,617.

Memory and processor RAM cache: 4MB 80-ns SIMMs, 128K cache.

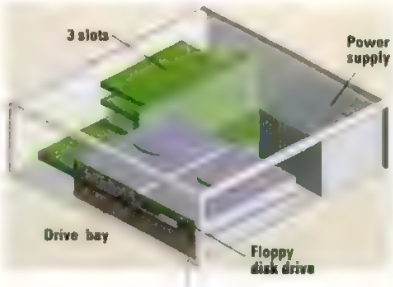
Disk drives and controller: Seagate 15-ms 211MB IDE hard disk, C&T controller, 1.44MB floppy disk drive.

Display: Everex 1,024-by-768 adapter with 512K RAM, Everex 13-inch monitor, 56-Hz refresh rate.

Software: DOS 5.0, Microsoft Windows 3.1.

In short: The Everex Tempo C Series 486SX/25's attractive case belies the system's poor disk performance and lack of a competitive price.

483 ON READER SERVICE CARD



scores were above average. In the past, PC Magazine Labs has seen performance degradation in many systems using a plug-in upgradability design, so Everex got the formula right. DOS video ranked above average as well, though Graphics Winmark was below.

Disk performance, however, was disappointing. Evidently, the low disk score resulted from a poor IDE subsystem. Although PC Labs' technicians tried various hard disks with the IDE controller, the results were the same. But when an IDE host adapter replaced the disabled IDE controller, the scores were in line with those of similar subsystems.

Everex's one-year parts-and-labor warranty includes free on-site service from NCS (National Computer Systems) the first year. Technical support is free but not toll-free; if incoming lines are busy, the company will call you back.
—*Camille N. Cline*

Gateway 2000

Gateway 2000 25MHz/486SX

The Gateway 2000 is hot on Dell System 486D/25's heels as the low-cost, full-featured mail-order PC of choice. But even though Gateway's $2,045 Gateway 2000 25MHz/486SX comes in at hundreds of dollars less than the Dell ($2,819), its interior design and to some degree its feature package aren't as shiny as the stuff from Texas. Only you can decide if the Dell's extra gloss is worth the money.

Some of the differences between the two are apparent just by gazing at the Gateway's case. Where Dell puts its power switch conveniently on the front,

The Gateway 2000 25MHz/486SX

LaserMaster

WinPrint Products

The Fastest Way to Print from Windows.

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When you're waiting for your Windows™ documents to print, seconds can drag into minutes, and minutes can drag into hours. And every hour you spend waiting for your pages to print is an hour away from your computer, and an hour that has to be made up at the end of the day.

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- ***True background printing*** so you can print your really long documents and keep working on your computer without any reduction in speed or performance.
- ***A revolutionary host-based design*** that means your printer will automatically print faster every time you upgrade your computer.

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WinPrinter™ 800

An 800-dpi laser printer designed for Windows.

LaserMaster has packed all its great WinPrint features into a compact 4-ppm laser printer. Plus, you'll be able to print all your work with 800-dpi resolution. With a WinPrinter, you'll be able to print your work faster and print it better

Retail Price $1595

WinJet™ 800 Upgrade

Turn your HP® LaserJet® into a fast, 800-dpi Windows printer.

The WinJet 800 upgrades an ordinary HP LaserJet II, IID, III, IIID to a fast, high-performance Windows printer. And the WinJet 800 lets you print with 800-dpi quality for a professional look that people will notice.

Retail Price $795

WinJet™ 300 Upgrade

For fast, feature-rich printing from your HP LaserJet.

If you want faster printing speeds and don't need 800 dpi, the WinJet 300 is the affordable solution. You'll get fast Windows printing plus all the great WinPrint features. No other LaserJet enhancement offers so much for such a low price

Retail Price $495

Don't waste any more time suffering with slow Windows printing. Call LaserMaster today and see how easy—*and affordable*—it can be to start experiencing fast, high-performance Windows printing.

Call 800-365-4646 or 612-944-9330.

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CIRCLE 195 ON READER SERVICE CARD

Gateway still mounts it in the rear. All the basics, though, such as five drive bays (three internal and two external) and a 200-watt power supply, are there.

The interior of the Gateway shows even more cut corners. The Gateway's motherboard is by Micronics, and though it too uses a Phoenix BIOS, that's where the similarity ends. Micronics likes to place its SIMM banks directly behind the expansion slots, which prevents at least four slots from holding full-length cards. Where the Dell's CPU was equipped with a heat sink even though it had a fairly clear air flow from the fan, the Gateway's processor has no heat sink despite the fact that its fan is blocked by dense cabling and a large drive bay assembly. Gateway claims it will soon be offering a processor cache upgrade module, which would place it one up on Dell, though neither unit has an OverDrive socket. The Gateway's Western Digital 202MB IDE hard disk with a 64K internal buffer is comparable to the Dell's Quantum ProDrive, though it is slightly smaller in both capacity and buffer size.

Video performance under Windows seems to be the only area where the Gateway clearly outstrips the Dell, thanks to its ATI Graphics Ultra adapter. With its speedy Mach 8 coprocessor and 1MB of video RAM, the ATI board showed some beautiful graphics on the Gateway's Crystal Scan monitor, which is the equal of the Dell's UltraScan in capability and its superior in ergonomics. Processor and memory scores were comparable for both machines (which means above average compared with the rest of the competition), with the Gateway pulling ahead by a few electronic hairs—nothing you'll notice in actual use, though. The Gateway's hard disk performed competitively compared with the other reviewed PCs.

Gateway offers a one year warranty including free on-site service for one year. Its technical support is toll-free and open 18 hours per day.—*OR*

FACT FILE

Gateway 2000 25MHz/486SX

Gateway 2000, 610 Gateway Dr., North Sioux City, SD 57049-2000; 800-523-2000, 605-232-2000; fax, 605-232-2023

List price (tested configuration): $2,045.

Memory and processor RAM cache: 4MB 70-ns SIMMs

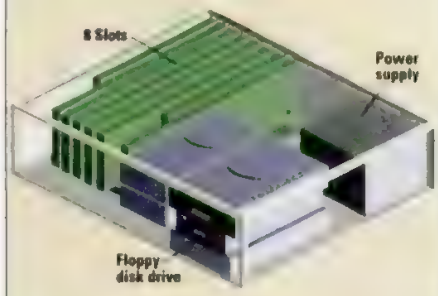
Disk drives and controller: Western Digital 15-ms 202MB IDE hard disk, 64K buffer, DFI controller, 1.2MB and 1.44MB floppy disk drives.

Display: ATI 1,024-by-768 local-bus adapter with 1MB RAM, Gateway 2000 14-inch monitor, 72-Hz refresh rate

Software: DOS 5.0, Microsoft Windows 3.1, choice of The Entrepreneur Pack, Microsoft Excel for Windows, Microsoft PowerPoint, Microsoft Project for Windows, Microsoft Word for Windows, Paradox, or The Windows Programmer Pack

In short: Not as shiny and detailed as the PC from Dell Computer Corp., the Gateway 2000 25MHz/486SX is nevertheless a low-cost entry from a major player

494 ON READER SERVICE CARD



IBM Corp.

IBM PS/2 Model 95 XP 486SX/25

The IBM PS/2 Model 95 XP 486SX/25 packs a lot of quality, functionality, and upgradability into a single MCA tower unit. But these cost a lot—roughly four times what the majority of the systems covered here cost. This $11,295 PC (with 8MB of RAM, a 400MB SCSI hard disk, XGA graphics, a 14-inch IBM 8515/A display, PC-DOS 5.0, and a PS/2 mouse) is designed for the corporate user looking for a a quality design, upgradability, and room for MCA bus-mastering expansion.

IBM Corp.'s upgradable motherboard, used throughout the PS/2 Model 95 line, has eight 32-bit MCA expansion slots; six were free in our test unit. The processor module carries an IBM chip set and an upgradable IBM flash ROM BIOS; to upgrade, change the processor module. Our test unit came with a 486SX/25 module that lacks provision for a secondary cache; however, some upgrade cards allow a secondary cache module to piggyback the processor card. There is also a socket for an OverDrive chip.

The Model 95 has five front-accessible drive bays, and one of the two internal drive bays holds the system's hard disk. For the hard disk subsystem, IBM uses an updated version of its own 32-bit MCA SCSI controller with 512K of disk cache. This new one, which yields better performance than IBM's older 32-bit SCSI caching disk controller, can drive up to five additional devices. These include IBM's magneto-optical or CD-ROM drives, either internal or external. The other occupied MCA slot holds a 1MB IBM XGA adapter capable of

FACT FILE

IBM PS/2 Model 95 XP 486SX/25

IBM Corp., 1133 Westchester Ave., White Plains, NY 10604; 800-426-9292

List price (tested configuration): $11,295

Memory and processor RAM cache: 8MB 70-ns SIMMs

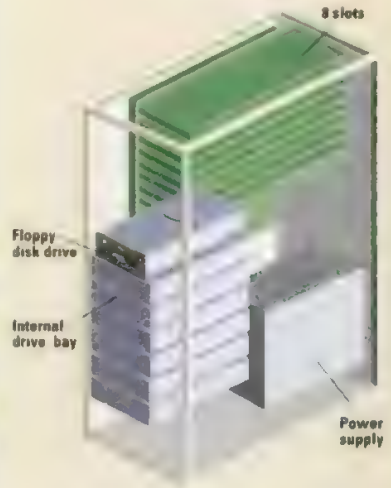
Disk drives and controller: IBM 11.5-ms 400MB SCSI hard disk, IBM controller, 512K cache, 2.88MB floppy disk drive

Display: IBM 1,024-by-768 adapter with 512K RAM, IBM 14-inch monitor, 70-Hz refresh rate

Software: PC-DOS 5.0

In short: The IBM PS/2 Model 95 XP 486SX/25 has a strong name, a solid design, and a steep price

495 ON READER SERVICE CARD



The IBM PS/2 Model 95 XP 486SX/25

1,024-by-768 resolution with 256 colors.

With this configuration, the Model 95 yielded average performance on all our tests. IBM products are distributed through dealers, which means that service agreements vary.—*WB*

i Corp

i Corp Blazer IIs

The i Corp Blazer IIs is packed with some unconventional features and components. Its $9,295 price tag is enough to make most buyers flinch, but a good portion of the cost belongs to its massive hard disk. More problematic is the pushed clock speed of its 486SX processor. If you can't stand the risk, this ISA server isn't the machine for you.

Even so, the Blazer's high-end cost buys some high-performance components packed into a surprisingly low-end tower case. The Blazer comes with 8MB of 60-nanosecond SIMMs (expandable to 32MB) and a 256K direct-mapped, write-through cache on an eight-slot ISA mini-AT system board. The motherboard holds sockets for a math coprocessor, a 386DX, and an OverDrive chip. In addition to the swing mount holding the 10-millisecond 1.4GB Micropolis SCSI-2 hard disk, there's room for three additional 5.25-inch units beyond the two installed floppy disk drives. The Blazer's Perceptive Solutions HyperStore 1600 SCSI-2 controller comes with a 4MB cache. Its video display subsystem is put together with a coprocessed Number 9 GX1 Lite 20 1,024-by-768 adapter with 1MB of RAM and a Sampo AlphaScan Plus monitor. You also get a 230-watt Power & Cooling power supply with a built-in UPS (uninterruptible power supply).

As delivered for our review, the Blazer runs its 486SX chip pushed beyond the Intel-supported 25-MHz clock speed rating. It uses a 56-MHz crystal running at a CPU clock speed of 28 MHz. i Corp says the ceramic-package chip runs at a cooler temperature and is capable of faster clock speeds. Intel does not support running the chip at pushed clock speeds and points out that reliablility and accuracy are compromised at higher-than-rated clock speeds. For our tests, we installed a 50-MHz crystal. At 25 MHz, the Blazer yielded average processor and memory scores; however, at 28 MHz, it produced the top measures on these same tests. The SCSI-2 controller with a 4MB cache coupled to the massive Micropolis hard disk gave an above-average disk score. Similarly, the Number 9 GX1 Lite 20 Super VGA adapter produced fine Graphics Winmark results; not designed for DOS video, it scored low on our video test.

We also tested the UPS. On our Battery Rundown test, it lasted 28 minutes without the monitor attached and powered on and less than 5 minutes with it attached. The UPS has no intelligence built in to shut down power-draining components, but it gives you enough time to save your work and turn everything off manually.

Undoubtedly, the Blazer is best used as the hub of a multiuser system. Its top-of-the-line hard disk, its expansion space (although space is wasted), its excellent power supply, and the added security of a UPS reinforce this purpose. The tower case that holds it all together is of poor quality, though: The jumbo Micropolis hard disk bent its swing mount. Also, the case incorporates none of the key design points common to good server platforms such as a locking front-access drive-bay panel and sturdy brackets.

The i Corp Blazer IIs

All service and repair is handled directly with Boston-based i Corp. You get a two-year warranty on parts and labor and a one-year warranty on the monitor. Extended service contracts run $250 a year.—*GP*

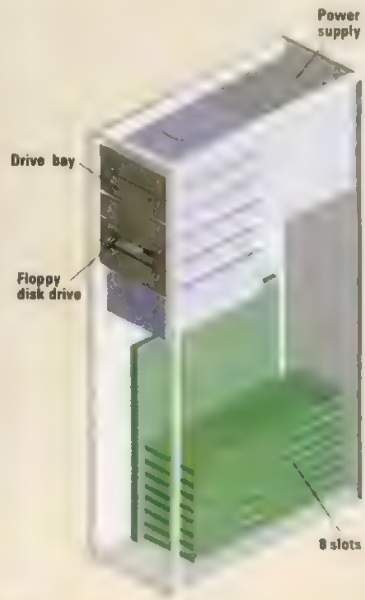
FACT FILE

i Corp Blazer IIs

i Corp, 398 Columbus Ave., #395, Boston, MA 02116; 617-424-7080; fax, 617-345-9632

List price (tested configuration): $9,295
Memory and processor RAM cache: 8MB 60-ns SIMMs, 256K cache
Disk drives and controller: Micropolis 10-ms 1.4GB SCSI-2 hard disk, Perceptive Solutions controller, 4MB cache, 1.2MB and 1.44MB floppy disk drives
Display: Number Nine 1,024-by-768 adapter with 1MB RAM, Sampo 14-inch monitor, 72-Hz refresh rate
Software: DR DOS, Version 6.0 (MS-DOS optional), Cache86, Close-Up Remote Control Software
In short: The i Corp Blazer IIs is an eccentric system at a price inflated by its massive hard disk. Pushed chips, a good power supply with a UPS, and a 1.4GB hard disk are wasted on the 486SX

496 ON READER SERVICE CARD



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—PC Magazine

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Insight Computers

Insight 486SX-25

The $1,799 Insight 486SX-25 is another ISA-based SX aimed at the price-pincher crowd. With average performance and a typical low-priced feature set, the Insight is not exceptional; you can flip a coin between this and most of the other low-priced standard-component solutions in this review group.

A small-footprint desktop case holds the usual three front-accessible horizontal 5.25-inch half-height drive bays (one is occupied by a 5.25-inch floppy disk drive) and two 3.5-inch half-heights mounted vertically (one is front-accessible and holds a 3.5-inch floppy disk drive).

The motherboard uses an AMI system BIOS and holds eight ISA slots (seven 16-bit and one 8-bit), of which six are left empty out of the factory. Cabling is messy, and SIMM banks push into the expansion slot areas, forcing the use of one 8-bit slot and possibly barring full-length cards from neighboring slots. A 64K processor RAM cache speeds up talking to the system RAM (4MB to 32MB). A coprocessor socket that can take an OverDrive upgrade neighbors the main processor, which is located in a standard socket.

A 234MB Quantum IDE hard disk with an internal 256K cache was attached to a multifunction IDE pass-through adapter with I/O interfaces. Video was handled by a Diamond SpeedSTAR adapter, which is identical to the regular SpeedSTAR except that it is equipped with a true-color RAMDAC. Unfortunately, this excellent card is attached to a 14-inch TVM monitor that displays 1,024-by-768 resolution at only 65 Hz and required almost constant image adjustment under Windows.

The system's performance produced another yawn. The 64K processor cache compromised test scores; the unit performed below average on both processor and memory tests. Since the Quantum hard disk lacked a true cache, its score was only in the midrange among the tested machines. Video performance was typical of the ET4000 chip set, which performed well on our DOS-based video test and well-below-average on our Graphics Winmark test—which may be just as well, considering the monitor seemed unsuited for Windows anyway.

Insight Computers offers a standard one-year warranty but no on-site service for its Insight 486SX-25. Technical support is available on a toll-free line 24 hours a day.—*OR*

The Insight 486SX-25

FACT FILE

Insight 486SX-25

Insight Computers (a division of Insight Distribution Network Inc.), 1912 W. Fourth St., Tempe, AZ 85281; 800-755-9628, 602-350-1176; fax, 602-350-1182

List price (tested configuration): $1,799.

Memory and processor RAM cache: 4MB 60-ns SIMMs, 64K cache.

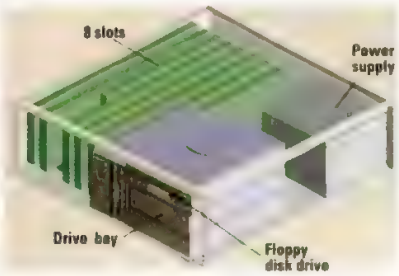
Disk drives and controller: Quantum 16-ms 234MB IDE hard disk, 1.2MB and 1.44MB floppy disk drives.

Display: Diamond 1,024-by-768 adapter with 1MB RAM, TVM 14-inch monitor, 65-Hz refresh rate.

Software: DOS 5.0.

In short: Insight's attractive low price is offset by average to subpar performance. The tested monitor wasn't up to the video card's abilities.

497 ON READER SERVICE CARD



International Instrumentation Inc.

Blue Max Monolith 486UP/25S

International Instrumentation's Blue Max Monolith 486UP/25S has the configuration and performance figures to back up its $2,997 price tag. With an upgradable Mylex motherboard that can handle clock speeds of up to 33 MHz and processors up to the 66-MHz DX2, it can serve as a platform for engineering and scientific workstations.

International Instrumentation uses both Mylex and AMI motherboards in ISA and EISA configurations in its systems. This seven-slot ISA machine comes with 4MB of RAM (expandable to 32MB). Though its drive bay space is limited to one slimline and two half-height bays, the Blue Max's 256K of direct-mapped, write-back cache; OPTi controller; and ZIF (zero-insertion-force) socket lend value to what might otherwise be an ordinary small footprint.

The Blue Max scored extremely well on our processor and memory tests. Its disk score was also extremely high, thanks to the installed 340MB Hewlett-Packard ESDI hard disk and the UltraStor caching controller with 4MB of RAM. The system's Diamond Stealth VRAM card's S3 accelerator yielded an above-average Graphics Winmark score. Not designed for DOS video, it delivered a typically low score on this test.

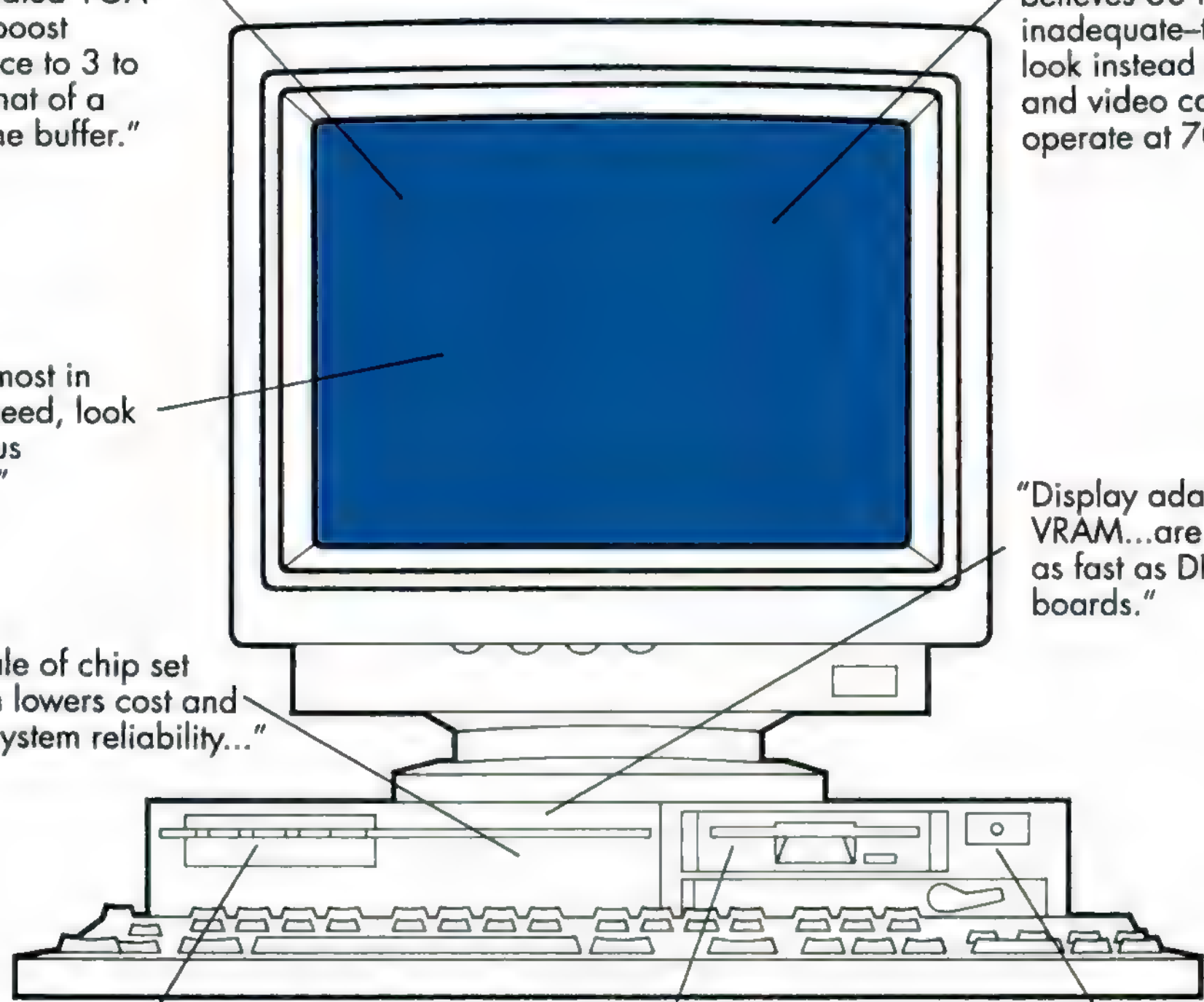
International Instrumentation's status as a Novell Gold reseller allows it to market its machines as file servers, which they have done in state and local government installations. As a file server, though, the

The Blue Max Monolith 486UP/25S

JULY 1992, PC MAGAZINE DESCRIBES THE PERFECT PERSONAL COMPUTER.

"...if your ultimate PC system runs Windows, an accelerated VGA card can boost performance to 3 to 20 times that of a dumb frame buffer."

"At 1,024-by-768 resolution, PC magazine believes 60 Hz is inadequate–too flickery–... look instead for monitors and video cards that operate at 70 or 72 Hz."



"For the utmost in display speed, look at local bus designs..."

"Display adapters using VRAM...are often twice as fast as DRAM-based boards."

"A high scale of chip set integration lowers cost and improves system reliability..."

"To save space, look for built-in parallel and serial ports, and IDE and video circuitry."

"To take advantage of a 32-bit operating system such as OS/2 2.0 or Windows NT (when it ships), you will want at least 8 MB of RAM, so a 16 MB motherboard may prove limiting in the next couple of years."

"Note that metal SIMM sockets are preferable to plastic ones."

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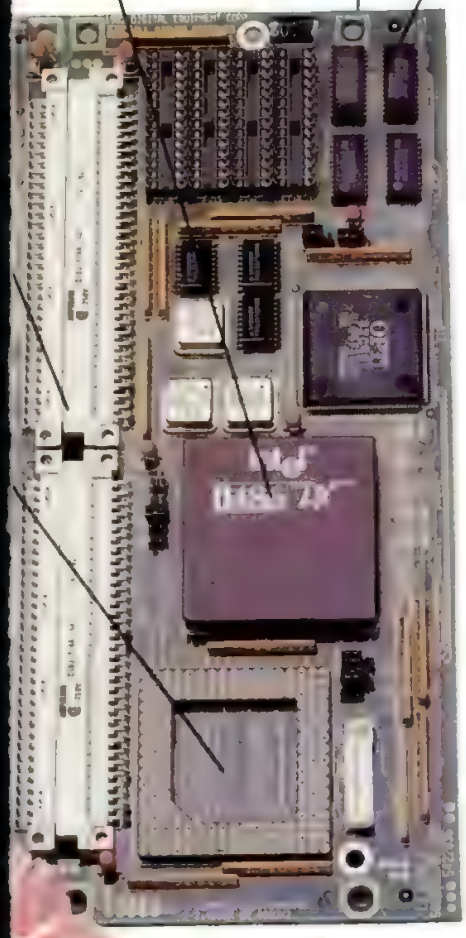
's OWE IT ALL TO MOTHER.

For faster video performance, take the local bus. This 32-bit data highway means your DECpc's microprocessor never slows down for video access.

your brain. / 486DX, and industry-standard processors are), in a wide range of speeds.

These DECpcs not only have a 128KB cache standard (with room for up to 256KB), it's writeback cache. That's the most advanced memory-caching strategy.



This couldn't be the perfect PC if it didn't have the perfect mother. Well, what a beauty she is.

Our new motherboard was born in Digital's very own, highly automated, ISO 9000-compliant factory. As opposed to somebody's garage.

But the real beauty of this mother is how much she does for you. She takes care of the floppy drive and the hard drive. Provides for the video controller and the GUI accelerator. Even tends to two serial ports and one parallel port. And because this motherboard takes care of all the basics, you can use her three expansion slots to truly customize your system.

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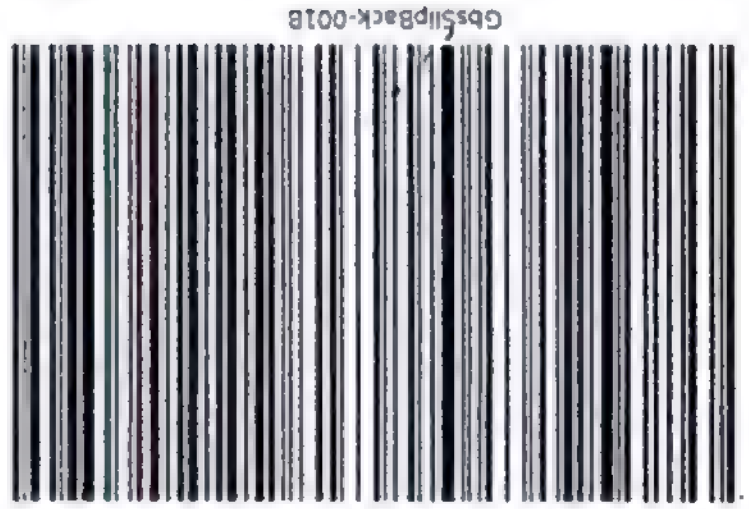
Upgradable	yes	yes	yes
Cache included	128KB	8KB	8KB
Cache maximum	256KB	64KB	256KB
GUI acceleration	yes	yes	no
Local bus video	yes	no	no
Maximum RAM	64MB	32MB	64MB
Hard disk bays	2	1	1
List price	$1,849	$2,449	$1,849
Estimated street price	$1,849	$2,252	$1,849
30-day money-back guarantee	yes	no	yes
Shipping included	yes	N/A	no

4MB RAM, 120MB hard drive, keyboard, mouse, DOS, Windows, no monitor. Competitive price survey 8/10/92.



Back

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Inverted Back

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GbsSlipSheet-001

Foldout slip-sheet

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2. Insert this sheet with
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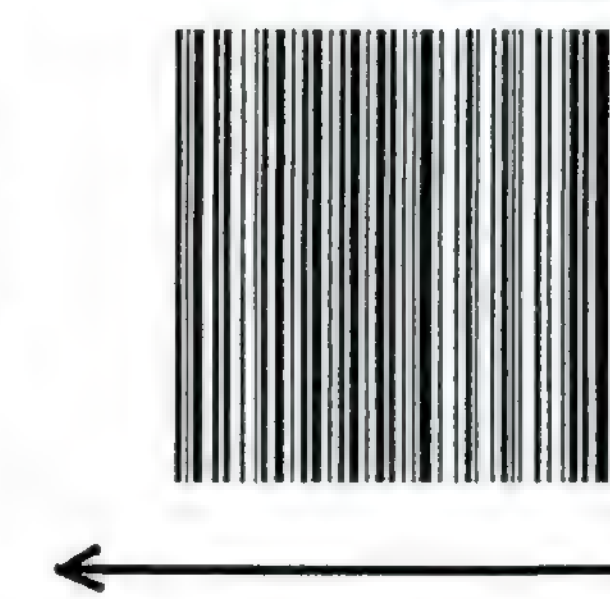
4. Close the page and slip-sheet



Inverted Foldout slip-sheet

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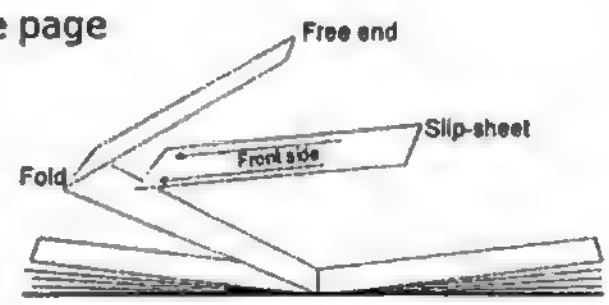

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DECpc

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• Keyboard, mouse, MS-DOS and Windows
• Free shipping.

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• 4MB RAM • 122MB hard drive
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• 3.5" 1.44MB floppy drive
• Keyboard, mouse, MS-DOS and Windows
• Free shipping.

DECpc 466d2 LP
486DX2 66 MHz System
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• SVGA non-interlaced color monitor (14", 1024 x 768, 0.28 mm)
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Up to 72 Hz refresh rate

Local bus video

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Upgradable design

Up to 64MB RAM on motherboard

Built-in parallel and serial ports, IDE and video circuitry

VRAM instead of DRAM

DECpc 425sx LP 486SX 25 MHz System

•4MB RAM •122MB hard drive •VGA color monitor (14", 0.29mm)
•3.5" 1.44MB floppy drive •Keyboard, mouse, MS-DOS and Windows
• Free shipping.

Monitors may differ from those shown.

6 LBS. FULLY LOADED!

The DECpc 325P gives you the best features of all the best desktop PCs and notebooks rolled into one. Features like an NiMH battery, to keep you up and running for 4 straight hours. 25MHz of power. Your choice of 4MB RAM with an 80MB Hard Drive or 8MB RAM with an impressive 120MB Hard Drive. Factory installed MS-DOS 5.0 and Windows 3.1. A 9600 bps FAX modem with FAXit™ for Windows. And the best feature of all – low price.

•386SL 25MHz System
•4MB RAM • 80MB Hard Drive
•10" Triple Super Twist Backlit VGA
•LCD, 3.5" 1.44MB Floppy Drive
•Built in trackball and Logitech™ TrackMan® Portable
•Price: $2,795

•386SL 25MHz System
•8MB RAM • 120MB Hard Drive
•10" Triple Super Twist Backlit VGA
•LCD, 3.5" 1.44MB floppy drive
•Built in trackball and Logitech TrackMan Portable
•Price: $3,295

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DECpc™ 333sx LP

Powerful, entry-level Windows™ computing

The DECpc 333sx LP gives
you big power — at a little price.

- 386SX 33MHz System
- 64KB cache
- 4MB RAM • 122MB Hard Drive
- 14" VGA Color Monitor
- 3.5" 1.44MB Floppy Drive
- Keyboard and Mouse
- MS-DOS 5.0 and Windows 3.1 installed
- Price: $1,549

ACT BEFORE OCTOBER 30 AND GET A FREE APPLICATION!

Right now, buy any DECpc Desktop or Notebook, and choose any one of these popular programs absolutely free. But hurry! Special offer expires October 30, 1992.

Application	Retail Value
Lotus® 1-2-3® for Windows	$595.00
Lotus Ami Pro™ 2.0	$495.00
Lotus Freelance Graphics™ for Windows	$495.00
Lotus Works™ 3.0	$149.00
Lotus Agenda® 2.0	$199.00
Lotus 1-2-3 version 3.1+	$595.00
Lotus 1-2-3 version 2.4	$495.00
Lotus Freelance for DOS	$495.00

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1992 DEC named fastest growing PC vendor. Announces full line of high-performance, low-profile upgradable PCs.

1992 DEC opens the world's most advanced PC manufacturing plant to produce a new generation of more powerful PCs.

1991 DEC and Microsoft® announce a joint development alliance, giving each company access to the other's technology and service resources.

1990 Digital introduces and shares water-based manufacturing technology that will eliminate fluorocarbons that destroy the Earth's atmosphere.

1988 Digital expands its Network Application Support (NAS), unveiling the industry's most open computing environment for the 1990s.

1988 Digital and Apple announce an agreement to link Macintosh® and AppleTalk® with VAX® and DECnet/OSI enterprise networks.

1980 Digital, Intel™ and Xerox® jointly introduce Ethernet.

1977 First VAX is introduced.

1960 Digital ships world's first PC (PDP-1). Includes first interactive computer game.

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A towering achievement

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- 486DX2 66MHz System
- 128KB Cache • 4MB RAM
- 105MB Hard Drive
- 14" Low Radiation SVGA Non-Interlaced Monitor (supports up to 1024 x 768)
- 3.5" 1.44MB Floppy Drive
- MS-DOS 5.0, Windows 3.1 and Mouse

* Price shown includes 14" monitor. Photograph shows 19" monitor available for $5,399

	DIGITAL	COMPAQ	IBM	DELL
Free one year service performed by manufacturer	YES	NO	NO	NO
30-day, no questions asked money back guarantee	YES	NO	NO	YES
Multivendor service support available	YES	NO	YES	NO
Application support available	YES	NO	YES	NO

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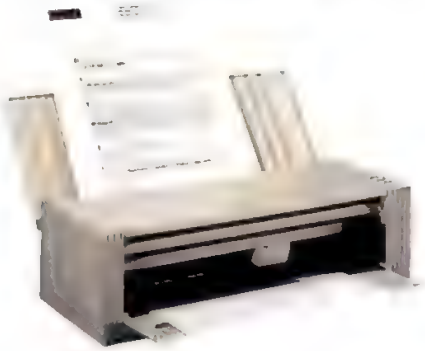
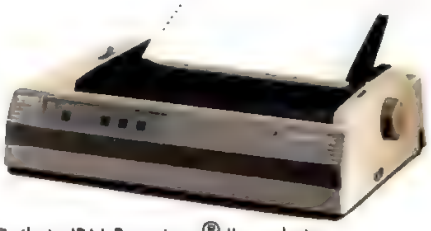
Order a Digital printer when you buy any Digital PC before October 25, 1992, and get 10% off the price of the printer. Choose any popular laser, ink-jet or dot matrix printer, and you'll get this special savings *plus* • **Free** One Year On-Site Service • **Free** Delivery • **Free** Parallel Cable.

DECmultiJET 1000: Laser quality printing at a less than laser price



- Bubble ink-jet printer with 50-nozzle printhead
- Built-in HP® DeskJet Plus® emulation
- Prints up to 160 characters per second
- 300 x 300 dots per inch resolution
- Prints on plain paper, transparencies, envelopes
- Cartridge slot for emulation, font or RAM upgrade
- Resident Fonts: Courier, Courier Landscape, Times Nordic, Letter Gothic
- Price: ~~$329~~ $296.10
- Order No. FR-LJ16P-AA

DEC LA70: High quality dot-matrix printing at a special low price



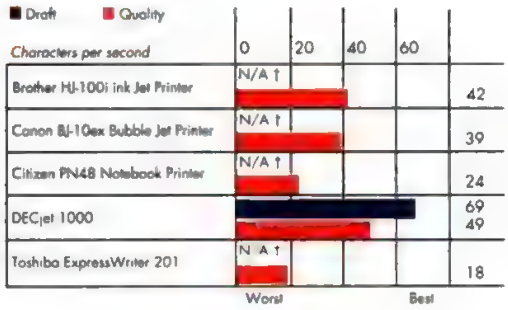
- Built- in IBM Proprinter® II emulation
- 9-Wire, narrow carriage
- Prints up to 200 characters per second
- Supports MS Windows
- Serial and parallel interface
- Draft, memo or near letter quality printing
- Handles fanfold, cutsheet, envelopes, labels and 3-part forms
- Price: ~~$299~~ $269.10
- Order No. FR-LA5S-AA/ZTY

THE FASTEST PRINTERS ON THE ROAD TODAY.

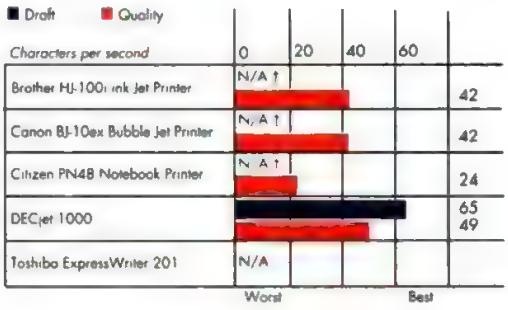
PC MAGAZINE LABS

In head to head tests, *PC Magazine* pitted the DECmultiJET 1000 ("DECjet 1000") against portable printers from Brother, Canon, Citizen, Kodak® and Toshiba®. The results? *PC Magazine* reports "the DECjet...had the highest speeds in quality printing: 49 cps in both emulations."

Epson Emulation



IBM Emulation



N/A † Not applicable. This printer does not operate in draft mode
N/A †† Not applicable. This printer does not support this emulation

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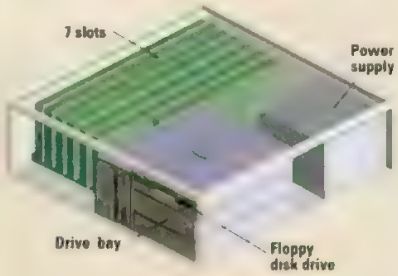
FACT FILE

Blue Max Monolith 486UP/25S

International Instrumentation Inc., 2282 Townsgate Rd., Westlake Village, CA 91361; 800-543-3475, 805-495-7673; fax, 805-379-0701

List price (tested configuration): $2,997
Memory and processor RAM cache: 4MB 80-ns SIMMs, 256K cache
Disk drives and controller: Hewlett-Packard 17-ms 340MB ESDI hard disk, UltraStor controller, 4MB cache, 1.2MB and 1.44MB floppy disk drives.
Display: Diamond 1,024-by-768 adapter with 1MB RAM, ViewSonic 14-inch monitor, 60-Hz refresh rate.
Software: DOS 5.0, Microsoft Windows 3.1.
In short: This PC's performance justifies its higher-than-average price, and it has good upgrade potential

498 ON READER SERVICE CARD



unit is appropriate for small workgroups only. But the good construction of the system as a whole and a motherboard engineered for a logical upgrade path make it an attractive workstation. The Blue Max benefits from a selection of solid components, and its overall fine performance can't be ignored.

International Instrumentation issues a one-year warranty on parts and labor; extended contracts are 8 percent of the purchase price. On-site service is handled by TRW's network of service centers. Toll-free technical-support lines are open from 8:00 to 7:00 Pacific time.—*GP*

Keydata International Inc.

KEY486S-25 ISA

Though Keydata International's $2,195 KEY486S-25 ISA offers a few refined features, it is still an ISA-based system with economical components aimed at the cost-conscious market. The only

The KEY486S-25 ISA

problem is the compeition: many other machines cost about the same or less.

The mini-tower case holds no surprises, offering six drive bays: three 5.25-inch drives and one 3.5-inch slimline are accessible; two more are internal. The unit is powered by a 230-watt power supply and sports a front-mounted power switch. The video adapter and I/O disk controller fill two of the six 16-bit slots.

The Keydata's A-SUS motherboard has an AMI BIOS and holds from 1MB to 32MB of system RAM, which is expandable to 64MB via a proprietary memory expansion slot. The 256K processor RAM cache, managed by a SIS controller, has a direct-mapped, write-through architecture.

TEAC makes the two floppy disk drives, while Maxtor makes the 210MB IDE MXT7213AT hard disk with its 64K internal buffer. The Maxtor drive is linked to a noteworthy component: a Chicony CH-1016 16-bit hard disk controller that not only holds all the I/O interface ports but engages an 80186 processor to handle from 1MB to 16MB of hardware disk cache. Floppy disk control is integrated onto the motherboard.

A Prolink graphics adapter that exhibits a typical implementation of the S3 GUI accelerator is wired to another element often found in low-cost systems: a 14-inch ViewSonic 6 multiscanning monitor, capable of 1,024-by-768 resolution at 60 Hz. Our sample had trouble adjusting to an 800-by-600 Windows screen. Keydata says it now ships standard a CTX 5468 monitor with a 70 Hz refresh.

Performance was a mixed bag. Processor and memory scores were both high—evidence of the 256K secondary

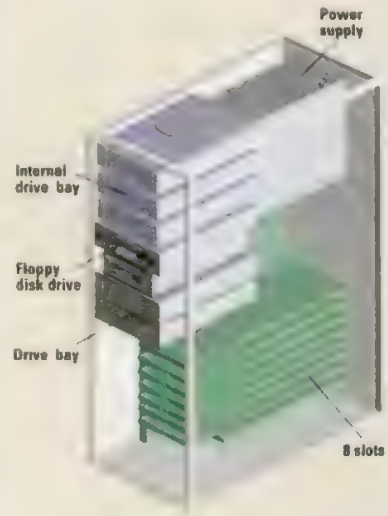
FACT FILE

KEY486S-25 ISA

Keydata International Inc., 111 Corporate Blvd., S. Plainfield, NJ 07080; 800-486-4800, 908-755-0350; fax, 908-756-7359

List price (tested configuration): $2,195.
Memory and processor RAM cache: 4MB 60-ns SIMMs, 256K cache
Disk drives and controller: Maxtor 16-ms 210MB IDE hard disk, 64K buffer, Chicony disk controller with 1MB cache, 1.2MB and 1.44MB floppy disk drives
Display: Prolink 1,024-by-768 adapter with 1MB RAM, ViewSonic 14-inch monitor, 60-Hz refresh rate
Software: DOS 5.0, Microsoft Windows 3.1
In short: Although this is a solid PC, it is not inexpensive enough to be extremely price-competitive. Keydata International needs to decide which audience it wants to target

499 ON READER SERVICE CARD



cache. The Chicony hard disk controller also zoomed into a well-above-average spot. Video was the Keydata's only shortfall: a plunging video score and a Graphics Winmark score that strained to reach the bottom rung of average.

Ergonomically, the Keydata wasn't half bad. System documentation was surprisingly clear and complete. The 101-key keyboard was differentiated by its built-in calculator. Sold direct, the system carries a pleasant 18-month parts-and-labor warranty (though the monitor is covered for only 12 months) and toll-free technical support during East Coast business hours.—*OR*

25-MHz 486SX PCs

List price (*PC Magazine* configuration) For this review of 25-MHz 486SX computers, we requested a configuration that included 4MB of RAM, a 200MB hard disk, a Super VGA color display subsystem capable of at least 800-by-600 resolution with 256 simultaneous colors, one parallel and two serial ports, DOS 5.0, and Microsoft Windows 3.1.

Unless otherwise noted, all table entries refer to the range of options available in the systems reviewed.

PC Magazine also uses a standard, or as-tested, configuration price. This is the price of the system as tested by *PC Magazine*, and may include extra-cost options. The standard configuration price is cited in the review, and in the Price/Performace Index chart.

Distribution channel Some machines are sold directly through mail order, others through dealers, and increasingly through company-owned stores and superstores. Dealers have previously offered discounts of 25 percent or more off the list price; however, an industry-wide price restructuring has cut these discounts in many cases. *PC Magazine* views a 15 percent discount as typical.

The **chip set manufacturer** makes the logic that connects the CPU with the other functions managed by the system board.

A **ZIF (zero-insertion-force) socket** has a lever that allows you to remove and replace the CPU easily.

The **BIOS version (or date)** can affect PC Magazine Labs' benchmark test results. A machine with a different BIOS may perform differently.

Flash memory contains BIOS code that can be updated via software. The BIOS is generally stored in conventional ROM, which has no provision for modification.

Installable RAM indicates the amount of memory that can be installed using any combination of chips and proprietary cards.

Cache architecture A *four-way set-associative* cache, native to the 486's internal 8K cache, divides data into four equal blocks and is viewed as most effective. A *two-way* cache's data is split into two equal blocks, and the data in a *direct-mapped* cache (the most common and least costly) is not divided.

Cache write policy A *write-back* design can cache data read from and written to memory. This method is theoretically superior to that of a *write-through* cache, in which only reads from memory are cached.

Front-accessible drive bays can be reached from the system's front panel and can support removable media (such as tape and CD-ROMs); **internal drive bays** can be reached only by opening the case. We report the maximum number of accessible and internal drives the system can hold.

Floppy disk drives indicates whether the vendor equips its base-priced system with a 1.2MB floppy disk drive, a 1.44MB floppy disk drive, or both.

Hard disk options We report the range of hard disk capacities the vendor offers.

Disk controller location A computer with IDE (integrated drive electronics) circuitry has its controller functions integrated onto the drive and motherboard or through a separate pass-through controller.

Disk controller location A computer with IDE (integrated drive electronics) circuitry has its controller functions integrated into the drive and motherboard but may have a separate controller.

Expansion bus For each type of expansion slot—8-bit, 16-bit, 32-bit EISA/MCA, and 32-bit proprietary—we report the number of slots on the motherboard. We also indicate whether the motherboard contains integrated parallel, serial, or mouse ports.

The **display circuitry** can reside on an expansion card or on the motherboard. Motherboard circuitry is often faster, but if it cannot be disabled there is no way to upgrade it.

The **video chip set manufacturer** makes the logic that runs the video adapter.

The **number of device connectors** indicates how many internal storage devices the power supply can support without requiring Y cables (power splitters).

Software refers to any programs bundled with the system, free of charge. This category includes various versions of DOS, disk-caching software (such as SMARTDRV.SYS), expanded-memory-management software (such as QEMM-386), Microsoft Windows 3.0 or 3.1, and any applications the vendor supplies as extras. (If DOS and Windows are not bundled free with a system, the prices are added to arrive at the *PC Magazine* standard configuration.)

The **first-year on-site service charge** may be included in the price of the system, or it may be a set or variable amount. If the charge varies, it is often determined by the system's configuration and cost.

FCC Class B identification number Systems with a Class B rating from the Federal Communications Commission have sufficiently low radio-frequency emissions to be used in the home. To verify any system's status, you may dial up the Public Access Link, the FCC's own bulletin board service, at 301-725-1072.

Lightning Computers

Lightning Omniflex 486SX25

At $1,695, the Lightning Omniflex 486SX25 represents a superior value among the 58 PCs reviewed here, with good expansion room in its standard-width chassis, an OverDrive socket, quality components, and a two-year warranty. It's one of the more outstanding bang-for-the-buck performers, and earns one of our two Editors' Choice designations, along with the Ariel 486SX/25.

The standard desktop case has all the features you need: six bays (four accessible), a healthy 250-watt power supply, eight ISA slots (seven free out of the factory), and an OverDrive slot.

Inside is a pretty picture, too. An AMI and HyQuest Super Voyager motherboard holds the Intel 25-MHz processor and a neighboring OverDrive slot, 1MB to 128MB of RAM, and a 64K processor RAM cache. Plus, this integrated design also holds all the I/O circuits, the floppy disk drive controller chips, and the IDE controller circuits for the 213MB Quantum ProDrive LPS 240-AT hard disk (yes, the one with the handy internal 256K buffer). Video may not be integrated, but at least the company chose a real boomer to occupy the expansion slot: an ATI Graphics Ultra with the Mach 8 video accelerator and 1MB of video

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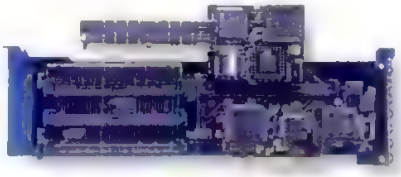

Kingston TECHNOLOGY CORPORATION

THE INSIDE NAME IN UPGRADES

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CIRCLE 106 ON READER SERVICE CARD

▶ SUMMARY OF FEATURES

486SX/25 PCs

Products listed in alphabetical order

■ = YES □ = NO

	ACMA 486SX/25	ALR Flyer 32DT 4SX/25	Amax 486SX/25 Power Station	Amkly 486SX/25E	Arche Legacy 486SX/25	Ariel 486SX/25 (PC Editors' Choice)
List price (*PC Magazine* configuration)	$3,894	$3,101	$2,499	$3,250	$4,521	$2,290
Hard disk capacity	245MB	213MB	240MB	345MB	200MB	234MB
Distribution channel	Direct	Dealers, direct	Dealers	Dealers	Dealers	Direct
Case style	Tower	Small-footprint	Desktop	Small-footprint	Desktop	Tower
Bus architecture	EISA	ISA	EISA	EISA	ISA	ISA
Motherboard						
Motherboard manufacturer	Helm Engineering	ALR	Amax	Amkly	Arche	Micronics
Chip set manufacturer	SIS	UMC, WD	Intel	Intel	Arche, Siemens	C&T, Micronics
ZIF (zero-insertion-force) socket	□	□	□	□	□	□
Upgradable processor	■	■	■	□	□	■
BIOS version (or date)	Award (July 1991)	Phoenix 1.01	Award 4.0	Phoenix 1.0	AMI (April 1992)	Phoenix (January 1988)
Flash memory	□	■	□	■	□	□
Weitek or Cyrix coprocessor support	■	■	□	■	■	□
Memory and Processor RAM Cache						
Installable RAM	2MB–32MB	4MB–36MB	4MB–64MB	4MB–64MB	4MB–32MB	4MB–64MB
Installable RAM cache	64K–256K	N/A	64K–256K	N/A	128K	64K–256K
Cache architecture	Four-way set-associative	N/A	Direct-mapped	N/A	Direct-mapped	Four-way set-associative
Cache write policy	Write-through	N/A	Buffered write-through	N/A	Write-back	Write-back
Disk Drives						
Front-accessible drive bays	Four 5.25-inch	One 5.25-inch, one 3.5-inch	Three 5.25-inch	Two 5.25-inch, one 3.5-inch	Three 5.25-inch	Four 5.25-inch
Internal drive bays	4	1	2	1	1	2
Floppy disk drives	1.2MB, 1.44MB	1.2MB, 1.44MB	1.2MB, 1.44MB	1.2MB, 1.44MB	1.44MB	1.2MB, 1.44MB
Hard disk options	245MB	80MB–535MB	52MB–1.4GB	40MB–2GB	80MB–650MB	80MB–535MB
Disk controller location	Card	Motherboard	Card	Motherboard	Card	Card
Expansion Bus						
8-bit slots	None	None	None	None	1	None
16-bit slots	None	3	None	None	7	8
32-bit EISA or MCA slots	8	None	8	7	None	None
32-bit proprietary slots	None	3	None	2	None	None
Parallel, serial, mouse ports on motherboard	None	1, 2, 0	None	1, 2, 1	1, 2, 0	None
Video						
Display circuitry location	Card	Motherboard	Card	Motherboard	Card	Card
Video chip set manufacturer	ATI	WD	Tseng	Trident	Tseng	S3
Power Supply						
Power supply (watts)	250	145	250	200	200	250
Number of device connectors	6	3	6	4	4	4
Software						
DOS 5.0	■	■	■	■	■	■
Microsoft Windows 3.1	■	■	■	■	■	■
Miscellaneous						
Warranty	1 year	1 year	1 year	1 year	2 years	1 year
First year on-site service charge	Included	$10	$125	Included	Included	Included
FCC Class B identification number	IR7ACMA4864	E7YFR32B5	None	IFWAKREN48625SXE	GVW486-2551	IWS486SX25CMB

N/A—Not applicable. The product does not have this feature. AMI—American Megatrends Inc. ATI—ATI Technologies Inc. BCM—BCM Advanced Research Inc. C&T—Chips & Technologies Inc. ERI—EMPaC Research Inc. ETEQ—ETEQ Microsystems Inc. SIS—Silicon Integrated Systems Corp. STB—STB Systems Inc. TI—Texas Instruments Inc. UMC—United Microelectronics Corp. VLSI—VLSI Technology Inc. WD—Western Digital Corp.

Atlas 486SX/25	ATronics ATI 486SX-25	Axik Ace Cache 486SX-25	BLK 486SX/25	Blue Star 486SX/25 Desktop	C² Saber 4X25	Comex 486SX-25	Compaq Deskpro 486S/25M	Compudyne 4SX/25
$1,999	$1,775	$2,498	$2,149	$1,849	$2,785	$2,395	$3,787	$1,499
210MB	211MB	245MB	203MB	213MB	245MB	212MB	212MB	200MB
Dealers	Dealers, direct	Dealers, direct	Direct	Dealers, direct	Dealers	Dealers	Dealers	Dealers, direct
nall-footprint	Small-footprint	Tower	Desktop	Desktop	Small-footprint	Small-footprint	Small-footprint	Small-footprint
ISA	ISA	ISA	ISA	ISA	ISA	ISA	EISA	ISA
Micronics	ATronics	Axik	Free Technology	Zenny	ERI	Micronics	Compaq	Compudyne
Micronics	UMC	Contaq	OPTi	UMC	Symphony	Micronics	Compaq	ACC Micro
☐	☐	■	☐	☐	☐	☐	☐	☐
■	■	■	■	■	■	Intel	■	☐
Phoenix anuary 1988)	AMI (July 1991)	AMI (December 1991)	AMI (June 1991)	AMI (July 1991)	AMI (July 1991)	Phoenix (January 1988)	Compaq (February 1992)	AMI 486 1.0
☐	☐	☐	☐	☐	☐	☐	☐	☐
■	■	☐	■	■	■	■	☐	■
4MB–64MB	1MB–64MB	4MB–32MB	4MB–32MB	1MB–64MB	1MB–64MB	4MB–64MB	4MB–64MB	1MB–32MB
64K–256K	64K–256K	64K–256K	64K–512K	64K–256K	64K–1MB	64K–256K	N/A	N/A
Four-way et-associative	Direct-mapped	Direct-mapped	Direct-mapped	Direct-mapped	Direct-mapped	Four-way set-associative	N/A	N/A
uffered write-through	Write-back	Write-back	Write-back	Write-back	Buffered write-through	Buffered write-through	N/A	N/A
ree 5.25-inch, two 3.5-inch	Three 5.25-inch, two 3.5-inch	Three 5.25-inch, two 3.5-inch	Two 5.25-inch	Three 5.25-inch, two 3.5-inch	Three 5.25-inch, one 3.5-inch	Two 5.25-inch, one 3.5-inch	One 5.25-inch, two 3.5-inch	Three 5.25-inch
1	1	3	2	None	1	1	1	2
2MB, 1.44MB	1.2MB, 1.44MB	1.2MB, 1.44MB	1.2MB	1.2MB, 1.44MB	1.2MB, 1.44MB	1.2MB, 1.44MB	1.44MB	1.2MB, 1.44MB
40MB–2GB	116MB–500MB	40MB–3GB	40MB–1.7GB	40MB–1.2GB	105MB–340MB	212MB–670MB	60MB–510MB	80MB–200MB
Card	Card	Card	Card	Card	Card	Card	Motherboard	Card
None	1	None	None	2	1	None	None	None
8	7	8	8	6	7	8	None	6
None	None	None	None	None	None	None	5	None
None	1	None	None	None	None	1	2	None
1, 2, 0	None	None	1, 2, 0	None	None	None	1, 2, 1	1, 2, 0
Card	Card	Card	Card	Card	Card	Card	Card	Card
S3	S3	S3	Tseng	Tseng	S3	Tseng	Compaq	WD
230	200	250	250	250	200	250	240	200
6	3	8	4	4	4	5	4	5
■	☐	■	■	■	■	■	☐	■
■	☐	■	☐	■	■	■	☐	■
1 year	1 year	13 months	1 year	1 year	1 year	2 years	1 year	1 year
$50	$99	$99	Included	$57	Included	Varies	Included	Included
None	E8M51GAT140X	I58ACECACHEDSX2	I49BLK486I	None	JDN486-SX	None	F139HB120376	I8HCOMPU4SX-25

CONTINUES

▶ SUMMARY OF FEATURES

Products listed in alphabetical order

■ = YES □ = NO

	Computer Sales Professional Pro 486SX/25	Copam 486SXB/25	CORE Model 95	CUBE 425ATX Upgradable System	Deico Predator 486SX/25	Dell System 486D/25
List price (*PC Magazine* configuration)	$1,699	$2,999	$12,695	$2,795	$1,995	$2,819
Hard disk capacity	212MB	210MB	520MB	212MB	200MB	245MB
Distribution channel	Direct	Dealers	Dealers	Direct	Dealers, direct	Dealers, direct
Case style	Small-footprint	Small-footprint	Tower	Mini-tower	Small-footprint	Small-footprint
Bus architecture	ISA	ISA	MCA	ISA	ISA	ISA
Motherboard						
Motherboard manufacturer	Computer Sales Professional	Copam	IBM	Dieco	Deico	Dell
Chip set manufacturer	VLSI	UMC	IBM	Symphony	C&T, Symphony	VLSI
ZIF (zero-insertion-force) socket	□	□	□	□	□	□
Upgradable processor	□	■	■	■	■	■
BIOS version (or date)	AMI (July 1991)	Phoenix 1.01	IBM (March 1992)	AMI (December 1991)	AMI 1.1	Phoenix (February 1992)
Flash memory	□	□	□	□	□	□
Weitek or Cyrix coprocessor support	■	■	□	■	□	□
Memory and Processor RAM Cache						
Installable RAM	4MB–32MB	1MB–64MB	8MB–64MB	1MB–64MB	1MB–64MB	4MB–64MB
Installable RAM cache	256K	64K–256K	N/A	64K–256K	64K–256K	N/A
Cache architecture	Direct-mapped	Four-way set-associative	N/A	Four-way set-associative	Four-way set-associative	N/A
Cache write policy	Write-through	Write-through	N/A	Write-through	Buffered write-through	N/A
Disk Drives						
Front-accessible drive bays	Three 5.25-inch, one 3.5-inch	Three 5.25-inch	Three 5.25-inch, two 3.5-inch	Two 5.25-inch, two 3.5-inch	Three 5.25-inch, two 3.5-inch	Three 5.25-inch
Internal drive bays	1	1	2	1	None	1
Floppy disk drives	1.2MB, 1.44MB	1.2MB, 1.44MB	1.44MB	1.2MB, 1.44MB	1.2MB, 1.44MB	1.2MB, 1.44MB
Hard disk options	120MB–200MB	40MB–310MB	520MB–4GB	120MB–540MB	40MB–1GB	80MB–1.4GB
Disk controller location	Card	Motherboard	Card	Motherboard	Motherboard	Motherboard
Expansion Bus						
8-bit slots	None	None	None	1	1	None
16-bit slots	8	5	None	6	6	6
32-bit EISA or MCA slots	None	None	8	None	None	None
32-bit proprietary slots	1	None	1	None	None	None
Parallel, serial, mouse ports on motherboard	1, 2, 0	1, 2, 0	1, 1, 1	1, 2, 1	1, 2, 1	1, 2, 1
Video						
Display circuitry location	Card	Motherboard	Card	Card	Card	Motherboard
Video chip set manufacturer	WD	Trident	STB	S3	NCR	WD
Power Supply						
Power supply (watts)	200	160	335	250	200	224
Number of device connectors	5	4	3	5	6	4
Software						
DOS 5.0	■	■	□	■	■	□
Microsoft Windows 3.1	■	□	□	■	■	□
Miscellaneous						
Warranty for motherboard	1 year	1 year	1 year	1 year	1 year; 2 years for motherboard	1 year
First year on-site service charge	Included	Included	Included	$50	$75	Included
FCC Class B identification number	E5QFTNB486SX-25P	DXOSB2430	None	IR9ATX01ZCUBE	HA3BAI06030	E2K486D

N/A—Not applicable. The product does not have this feature. AMI—American Megatrends Inc., ATI—ATI Technologies Inc., BCM—BCM Advanced Research Inc., C&T—Chips & Technologies Inc., ERI—EMPaC Research Inc., ETEQ—ETEQ Microsystems Inc., SIS—Silicon Integrated Systems Corp., STB—STB Systems Inc., TI—Texas Instruments Inc., UMC—United Microelectronics Corp., VLSI—VLSI Technology Inc., WD—Western Digital Corp.

FI Diamond eries Model 425SX	Diamond DT 486SX-25	DTx Voyager Model 425S	Eltech Model 4200	Ergo Moby Brick 486SX	Everex Tempo C Series 486SX/25	Gateway 2000 25MHz/486SX	IBM PS/2 Model 95 XP 486SX/25	i Corp Blazer IIs
$1,995	$1,795	$2,795	$1,699	$3,995	$3,617	$1,945	$11,295	$9,295
212MB	213MB	245MB	202MB	212MB	211MB	202MB	400MB	1.4GB
Dealers	Direct	Direct	Dealers, direct	Dealers, direct	Dealers	Direct	Dealers	Dealers, direct
mall-footprint	Small-footprint	Small-footprint	Small-footprint	Small-footprint	Slimline	Desktop	Tower	Tower
ISA	ISA	ISA	ISA	ISA	ISA	ISA	MCA	ISA
DFI	S&A Laboratory	AMI	Eltech	Ergo	Everex	Micronics	IBM	Maha
UMC	OPTi	AMI	Symphony	VLSI	Everex	C&T, Micronics	IBM	Symphony
☐	☐	☐	☐	☐	☐	☐	☐	☐
■	■	■	■	■	■	☐	■	■
MI (July 1991)	Phoenix (April 1990)	AMI (December 1991)	AMI (January 1992)	Ergo 2.11	AMI (August 1991)	Phoenix (January 1988)	IBM (March 1992)	AMI (May 1991)
☐	☐	☐	☐	■	☐	☐	■	☐
■	■	☐	■	☐	☐	☐	■	☐
1MB–64MB	1MB–32MB	1MB–32MB	1MB–64MB	4MB–32MB	4MB–32MB	4MB–32MB	8MB–64MB	8MB–32MB
64K—256K	N/A	64K–256K	N/A	N/A	128K	N/A	N/A	64K–256K
Four-way et-associative	N/A	Direct-mapped	N/A	N/A	Direct-mapped	N/A	N/A	Direct-mapped
uffered write-through	N/A	Write-back	N/A	N/A	Write-back	N/A	N/A	Write-through
wo 5.25-inch, one 3.5-inch	Three 5.25-inch, two 3.5-inch	Three 5.25-inch, two 3.5-inch	Three 5.25-inch, two 3 5-inch	One 3.5-inch	Two 3.5-inch	Three 5.25-inch	Three 5.25-inch, two 3.5-inch	Five 5.25-inch
1	None	None	None	None	1	2	2	2
2MB, 1.44MB	1.2MB, 1.44MB	1.2MB, 1.44MB	1.2MB, 1.44MB	1.44MB	1.44MB	1.2MB, 1.44MB	1.44MB	1.2MB, 1.44MB
212MB	40MB–1.7GB	120MB–425MB	80MB–1GB	80MB–1.2GB	40MB–1GB	80MB–1.2GB	80MB–1GB	224MB–2.2GB
Card	Card	Card	Card	Motherboard	Motherboard	Card	Motherboard	Card
2	2	1	1	1	None	2	None	None
5	6	7	7	1	3	6	None	8
None	None	None	None	None	None	None	8	None
1	None	None	None	2	None	1	1	None
None	None	1, 2, 0	None	1, 2, 0	1, 2, 0	None	1, 1, 1	None
Card	Card	Card	Card	Motherboard	Motherboard	Card	Card	Card
Tseng	S3	Tseng	S3	ATI	Tseng	ATI	IBM	TI
200	200	200	200	42	145	200	329	230
6	4	6	4	N/A	6	5	3	8
■	■	■	■	■	■	■	■ (PC-DOS 5.0)	■ (DR DOS 6.0)
■	■	■	■	■	■	■	☐	☐
1 year	15 months	1 year	1 year	1 year	1 year	1 year	1 year	2 years
Included	$75	N/A	Included	N/A	Included	Included	Varies	Varies
/DBV486DX-SX	JHT888486B	IUE6500252504	IOPERICOMP-425SX	IPV1486SX-20E	E3EEX-4600C-DX	HWYMG486SX	AN08595C50	None

CONTINUES

▶ SUMMARY OF FEATURES

Products listed in alphabetical order

■ = YES □ = NO

	Insight 486SX-25	International Instrumentation Blue Max Monolith 486UP/25S	KEY486S-25 ISA	PC MAGAZINE EDITORS' CHOICE Lightning Omniflex 486SX25	Media Micro Pro425SI	Mega Impact 486SX/25E+
List price (*PC Magazine* configuration)	$1,799	$1,897	$2,195	$1,695	$1,799	$2,300
Hard disk capacity	234MB	340MB	210MB	213MB	212MB	340MB
Distribution channel	Direct	Dealers, direct	Direct	Direct, company stores	Direct	Dealers, direct
Case style	Small-footprint	Small-footprint	Mini-tower	Desktop	Mini-tower	Tower
Bus architecture	ISA	ISA	ISA	ISA	ISA	EISA
Motherboard						
Motherboard manufacturer	Insight	Mylex	A-SUS	AMI, HyQuest	HyQuest	BCM
Chip set manufacturer	OPTi	OPTi	SIS	AMI, C&T, Siemens	UMC	Intel
ZIF (zero-insertion-force) socket	□	■	□	□	□	□
Upgradable processor	■	■	■	■	■	■
BIOS version (or date)	AMI (June 1991)	Mylex 6.13	AMI (May 1991)	AMI (December 1991)	AMI 1.0A	AMI (May 1991)
Flash memory	□	□	□	□	□	□
Weitek or Cyrix coprocessor support	■	■	■	■	■	■
Memory and Processor RAM Cache						
Installable RAM	4MB–32MB	1MB–32MB	1MB–64MB	1MB–128MB	1MB–64MB	1MB–64MB
Installable RAM cache	64K–256K	64K–256K	256K	64K–256K	0–256K	64K–256K
Cache architecture	Four-way set-associative	Direct-mapped	Direct-mapped	Four-way set-associative	Four-way set-associative	Direct-mapped
Cache write policy	Buffered write-through	Write-back	Write-through	Write-back	Write-back	Write-through
Disk Drives						
Front-accessible drive bays	Three 5.25-inch, one 3.5-inch	Two 5.25-inch, one 3.5-inch	Three 5.25-inch, one 3.5-inch	Two 5.25-inch, two 3.5-inch	Two 5.25-inch, two 3.5-inch	Four 5.25-inch
Internal drive bays	1	None	2	2	1	4
Floppy disk drives	1.2MB, 1.44MB	1.2MB, 1.44MB	1.2MB, 1.44MB	1.2MB, 1.44MB	1.2MB, 1.44MB	1.2MB, 1.44MB
Hard disk options	234MB–1GB	42MB–2.2GB	80MB–340MB	213MB–1GB	40M–1GB	200MB–4.5GB
Disk controller location	Card	Card	Motherboard	Motherboard	Card	Card
Expansion Bus						
8-bit slots	1	1	1	1	None	None
16-bit slots	7	6	6	7	7	1
32-bit EISA or MCA slots	None	None	None	None	None	6
32-bit proprietary slots	None	None	1	None	None	1
Parallel, serial, mouse ports on motherboard	1, 2, 0	1, 2, 0	None	1, 2, 0	None	None
Video						
Display circuitry location	Card	Card	Card	Card	Motherboard	Card
Video chip set manufacturer	Tseng	S3	S3	ATI	Tseng	S3
Power Supply						
Power supply (watts)	200	250	230	250	200	250
Number of device connectors	5	5	5	6	5	4
Software						
DOS 5.0	■	■	■	□	■	□
Microsoft Windows 3.1	□	■	■	□	■	□
Miscellaneous						
Warranty	1 year	1 year	18 months	2 years	1 year on parts, 5 years on labor	1 year
First year on-site service charge	Included	Included	Included	$100	N/A	N/A
FCC Class B identification number	JJK486SXC	None	JTFDATA486S	None	J3FMM486HQPRO	None

N/A—Not applicable. The product does not have this feature. AMI—American Megatrends Inc. ATI—ATI Technologies Inc., BCM—BCM Advanced Research Inc. C&T—Chips & Technologies Inc. ERI—EMPaC Research Inc. ETEQ—ETEQ Microsystems Inc., SIS—Silicon Integrated Systems Corp., STB—STB Systems Inc., TI—Texas Instruments Inc., UMC—United Microelectronics Corp., VLSI—VLSI Technology Inc., WD—Western Digital Corp.

	Memorex Telex 8080-25	Micro Express ME 486SX/ Local Bus/25	Micro Generation LB-25SX	Mitsuba Professional Upgradable	Myoda 486SX-25b	National Micro Systems Flash 486SX-25C	NCR System 3335	NEC PowerMate 486SX/25i
	$2,545	$1,866	$2,395	$2,850	$1,799	$1,999	$5,570	$3,298
	213MB	240MB	210MB	213MB	212MB	213MB	213MB	240MB
	Dealers	Direct	Dealers, direct	Dealers, distributors, superstores	Dealers, direct, company stores	Direct	Dealers	Dealers
	Small-footprint	Mini-tower	Small-footprint	Small-footprint	Small-footprint	Small-footprint	Desktop	Small-footprint
	ISA	ISA	ISA	EISA	ISA	ISA	MCA	ISA
	Cache Computers	Ergon	High Candor	Mitsuba	J-Bond Computer	AIR	NCR	NEC
	UMD	C&T, OPTi	OPTi	Intel	ETEQ	C&T, UMC	NCR	OPTi
	□	■	□	□	□	□	□	□
	■	■	■	■	■	□	■	■
	AMI (July 1991)	ETI/Phoenix 1.00	AMI (June 1991)	AMI (May 1991)	AMI (July 1991)	AMI (July 1991)	NCR 2.01	Phoenix 1.01
	□	■	□	□	□	□	■	■
	■	■	■	□	□	■	□	■
	2MB–64MB	4MB–32MB	1MB–32MB	1MB–64MB	1MB–32MB	1MB–64MB	4MB–192MB	4MB–36MB
	64K–256K	64K–256K	64K–256K	64K–256K	64K–256K	0–256K	N/A	64K–128K
	Direct-mapped	Direct-mapped	Direct-mapped	Direct-mapped	Four-way set-associative	Direct-mapped	N/A	Direct-mapped
	Write-back	Write-back	Write-back	Write-through	Buffered write-through	Buffered write-through	N/A	Write-back
	Three 5.25-inch	Three 5.25-inch, one 3.5-inch	Three 5.25-inch, one 3.5-inch	Three 5 25-inch	Three 5.25-inch, two 3.5-inch	Three 5.25-inch, two 3.5-inch	Two 3.5-inch	One 5.25-inch, one 3.5-inch
	1	1	1	1	None	None	1	2
	1.2MB, 1.44MB	1.2MB, 1.44MB	1.2MB, 1.44MB	1.2MB, 1.44MB	1.2MB, 1.44MB	1.2MB, 1.44MB	1.44MB	1.2MB, 1.44MB
	213MB–540MB	80MB–2GB	80MB–600MB	150MB–300MB	40MB–675MB	213MB–535MB	120MB–535MB	20MB–245MB
	Motherboard	Motherboard	Card	Card	Card	Card	Motherboard	Motherboard
	None	None	None	None	2	None	None	None
	7	7	8	None	6	7	None	4
	None	None	None	6	None	1	8	None
	1	None	2	1	None	None	1	None
	1, 2, 1	1, 2, 0	None	None	None	None	1, 4, 1	1, 1, 1
	Card	Motherboard	Card	Card	Card	Card	Motherboard	Motherboard
	ATI	Tseng	S3	Tseng	Tseng	S3	NCR	Tseng
	200	200	230	200	200	200	215	110
	5	5	5	5	6	5	4	3
	■	■	■	□	■	■	□	■
	■	■	■	□	■	■	□	■
	1 year	2 years	1 year on parts, lifetime on labor	1 year	1 year	15 months on parts, 2 years on labor	1 year	1 year
	Varies	$50	Included	$25	Varies	$75	$40	Included
	H3G808501	GXU309486SX	IZSNUREMAN48601	None	I6Y450CC	JDQ813KL33	C6P3432	B7ZEL486P

CONTINUES

▶ SUMMARY OF FEATURES

Products listed in alphabetical order

■ = YES □ = NO	NETiS ISA 425SX	Northgate Elegance ZXP	PCI 486SX-25C256	Poly 486SX-25Y	Silicon SVC-I486SX25-212	Softworks Citus MDC 486SX/25
List price (*PC Magazine* configuration)	$1,699	$2,649	$3,185	$2,395	$1,995	$2,695
Hard disk capacity	212MB	234MB	245MB	213MB	212MB	130MB
Distribution channel	Dealers, direct	Direct	Dealers, direct	Direct	Dealers	Dealers
Case style	Small-footprint	Small-footprint	Small-footprint	Tower	Small-footprint	Small-footprint
Bus architecture	ISA	ISA	EISA	ISA	ISA	ISA
Motherboard						
Motherboard manufacturer	Free Technology	Northgate	OPTi	Young Technology	SVC	Softworks Development
Chip set manufacturer	OPTi	OPTi	OPTi	Symphony	OPTi	UMC
ZIF (zero-insertion-force) socket	□	■	□	□	□	□
Upgradable processor	■	■	■	■	□	■
BIOS version (or date)	AMI (June 1991)	Mylex 6.10	AMI (July 1991)	AMI (July 1991)	SVC 4.02	AMI (May 1991)
Flash memory	□	□	□	□	□	□
Weitek or Cyrix coprocessor support	■	■	■	■	□	■
Memory and Processor RAM Cache						
Installable RAM	4MB–32MB	4MB–32MB	1MB–128MB	4MB–32MB	1MB–64B	1MB–32MB
Installable RAM cache	64K–256K	64K–256K	0–512K	64K–256K	N/A	64K–256K
Cache architecture	Four-way set-associative	Direct-mapped	Four-way set-associative	Direct-mapped	N/A	Direct-mapped
Cache write policy	Write-back	Buffered write-through	Write-back	Write-through	N/A	Write-back
Disk Drives						
Front-accessible drive bays	Three 5.25-inch, one 3.5-inch	Three 5.25-inch, two 3.5-inch	Three 5.25-inch, one 3.5-inch	Three 5.25-inch, two 3.5-inch	Three 5.25-inch, two 3.5-inch	Three 5.25-inch, two 3.5-inch
Internal drive bays	1	None	None	3	None	1
Floppy disk drives	1.2MB, 1.44MB	1.2MB, 1.44MB	1.2MB, 1.44MB	1.2MB, 1.44MB	1.2MB, 1.44MB	1.2MB, 1.44MB
Hard disk options	52MB–1.2GB	52MB–1.2GB	40MB–1.2GB	213MB–2GB	42MB–528MB	40MB–340MB
Disk controller location	Card	Motherboard	Card	Card	Card	Card
Expansion Bus						
8-bit slots	None	1	None	None	2	2
16-bit slots	8	6	None	8	6	5
32-bit EISA or MCA slots	None	None	8	None	None	None
32-bit proprietary slots	None	None	None	None	None	None
Parallel, serial, mouse ports on motherboard	None	1, 2, 0	None	None	None	None
Video						
Display circuitry location	Card	Card	Card	Card	Card	Card
Video chip set manufacturer	Tseng	S3	ACU-MOS	S3	S3	WD
Power Supply						
Power supply (watts)	200	200	200	230	220	300
Number of device connectors	4	5	4	5	4	4
Software						
DOS 5.0	■	■	■	■	□	■
Microsoft Windows 3.1	■	■	■	■	□	□
Miscellaneous						
Warranty	1 year	1 year	1 year	5 years on parts, 2 years on labor	1 year	1 year
First year on-site service charge	$60	Included	$35	$75	$190	$70
FCC Class B identification number	None	D5NMDI-25-16	None	ID9486SX	None	None

N/A—Not applicable. The product does not have this feature. AMI—American Megatrends Inc., ATI—ATI Technologies Inc., BCM—BCM Advanced Research Inc., C&T—Chips & Technologies Inc., ERI—EMPaC Research Inc., ETEQ—ETEQ Microsystems Inc., SIS—Silicon Integrated Systems Corp., STB—STB Systems Inc., TI—Texas Instruments Inc., UMC—United Microelectronics Corp., VLSI—VLSI Technology Inc., WD—Western Digital Corp.

	Spear Super 486SX/25	Swan 486SX/25DB	Tandy 4825 SX	Tangent Model 425se	Tri-Win 486SX/25	Twinhead Superset 600/425C	USA Flex 486SX/25 System	U.S. Micro Jet 486SX-25
	$2,825	$2,695	$3,058	$3,595	$2,095	$1,989	$1,929	$1,875
	213MB	202MB	240MB	212MB	210MB	213MB	203MB	203MB
	Direct	Direct	Dealers, company stores	Dealers, direct	Dealers, direct, company stores	Dealers	Direct	Dealers, company stores
	Tower	Small-footprint	Slimline	Small-footprint	Slimline	Slimline	Small-footprint	Slimline
	EISA	ISA	ISA	EISA	ISA	ISA	ISA	ISA
	Elisa	Swan	Tandy	Nice USA	Contaq	Twinhead	Cache Computers	Soyo
	OPTi	Syscon	VLSI	SIS	Contaq	Acer, Intel, Trident	UMC	ETEQ
	■	□	□	□	□	□	□	□
	■	■	□	■	■	■	■	■
	Award V.4.20	AMI 1.0	Phoenix 1.10	AMI (December 1991)	AMI (July 1991)	Award 3.15	AMI (July 1991)	AMI (July 1991)
	□	□	□	□	□	□	□	□
	■	■	□	■	■	■	■	□
	1MB–128MB	4MB–64MB	4MB–32MB	4MB–128MB	4MB–32MB	1MB–32MB	4MB–64MB	1MB–64MB
	64K–512K	128K	N/A	64K–256K	64K–256K	64K–256K	64K–256K	64K–256K
	Direct-mapped	Direct-mapped	N/A	Direct-mapped	Direct-mapped	Direct-mapped	Direct-mapped	Direct-mapped
	Write-back	Write-back	N/A	Write-back	Write-back	Write-through	Write-back	Write-through
	Two 5.25-inch, two 3.5-inch	Three 5.25-inch	One 5.25-inch, two 3.5-inch	Three 5.25-inch, one 3.5-inch	Three 5.25-inch, two 3.5-inch	Three 5.25-inch	Three 5.25-inch, two 3.5-inch	Three 5.25-inch, two 3.5-inch
	4	1	None	1	None	1	1	1
	1.2MB, 1.44MB	1.2MB, 1.44MB	1.2MB, 1.44MB	1.2MB, 1.44MB	1.2MB, 1.44MB	1.2MB, 1.44MB	1.2MB, 1.44MB	1.2MB, 1.44MB
	40MB–1.3GB	60MB–1.2GB	52MB–440MB	212MB–1GB	105MB–1.7GB	120MB–213MB	105MB–425MB	47MB–321MB
	Card	Motherboard	Motherboard	Card	Card	Motherboard	Motherboard	Card
	None	None	None	None	2	None	None	2
	None	5	3	2	6	4	7	6
	5	None	None	6	None	None	None	None
	3	1	None	None	None	None	1	1
	1, 2, 0	1, 2, 0	1, 2, 1	1, 2, 0	None	1, 2, 0	1, 2, 0	None
	Card	Motherboard	Motherboard	Card	Card	Motherboard	Card	Card
	Tseng	S3	WD	S3	Tseng	Trident	S3	Tseng
	230	200	100	300	200	150	200	230
	8	5	3	4	5	5	5	5
	■	■	■	■	■	■	■	■
	■	■ Quicken, Wealth Builder, Works for Windows	■ Microsoft Works for Windows	■	■	■	■	■
	1 year	2 years	1 year	1 year	2 years on parts, lifetime on labor	1 year	1 year	1 year on parts, 2 years on labor
	Included	Included	$179	Included	Included	Included	Included	$275
	IBD486SQV	HOYSWAN3486M-B	G7W559-25	None	G8YAES486QBD	FKGSS-600-420	None	IVUSOYO486

ENDS

RAM. This is cabled to the so-so 14-inch ViewSonic 6 monitor (with a 1,024-by-768 maximum at only 60 Hz).

Four megabytes of fast 60-nanosecond SIMMs and the 64K processor RAM cache explain the competitive processor and memory benchmark scores. The Quantum hard disk, having proved itself in many a system in this review group, didn't let us down on this system's disk test, either. The ATI Mach 8 gave its usual soaring Graphics Winmark score; not designed for DOS video, it yielded a mediocre result on our video test.

Okay, so it may not scream. But all of the above, a buffet selection of options, a two-year warranty, toll-free technical support, and one of the lowest prices in this review add up to a very attractive entry-level system.—*OR*

The Lightning Omniflex 486SX25

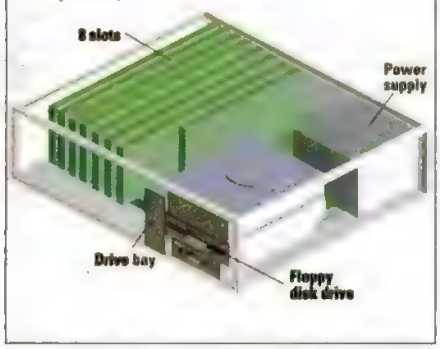
PC MAGAZINE EDITORS' CHOICE

FACT FILE

Lightning Omniflex 486SX25

Lightning Computers, 340 Brannan St., #200, San Francisco, CA 94107; 800-347-4486, 415-543-3111; fax, 415-543-3532

List price (tested configuration): $1,695.
Memory and processor RAM cache: 4MB 60-ns SIMMs, 64K cache.
Disk drives and controller: Quantum 15-ms 213MB IDE hard disk, 256K buffer, AMI and HyQuest disk controller integrated on motherboard, 1.2MB and 1.44MB floppy disk drives.
Display: ATI 1,024-by-768 adapter with 1MB RAM, ViewSonic 14-inch monitor, 60-Hz refresh rate.
Software: None.
In short: The Lightning Omniflex 486SX25 may seem like just another low-cost computer, but it is put together with as many high-quality components as possible and delivers solid performance. An outstanding value.
500 ON READER SERVICE CARD



Media Micro Inc.

Media Micro Pro425SI

The Media Micro Pro425SI is a sturdy, inexpensive mini-tower platform for whatever task you may have in mind. This efficiently compact $1,799 system is as easy to service as it is to slide under the desk. While Media Micro can put together a variety of other customized systems, you get a great price for the performance in this smart-looking package.

The Media Micro is more a standing small-footprint system than a mini-tower. Four drives are accessible (two 5.25-inch half-heights and two 3.5-inch slimlines); one 3.5-inch drive is internal. The unit has 4MB of RAM (with a 64MB system maximum on the motherboard) and 256K of direct-mapped, write-back cache. Its HyQuest Technology Pro425SI motherboard carries an AMI BIOS, UMC logic and cache controller, a 486SX in a standard socket, and a Weitek coprocessor socket, but no OverDrive socket. SIMM banks are arranged so as not to block the seven ISA slots; the video card and an IDE host I/O adapter fill two of them.

The Diamond SpeedSTAR HiColor video card, based on a Tseng ET4000 chip set with 1MB of RAM, can display 32,768 colors. Media Micro mates the adapter to a Microscan 1,024-by-768 monitor with a 60-Hz refresh rate but offers better displays for CAD work. The standard 212MB Conner hard disk has a 64K read-ahead cache and is controlled by an uncached Microwise controller.

Processor and memory performance reflects the help of the 256K secondary cache, resulting in very competitive scores. Disk performance was below average overall but in line with the test

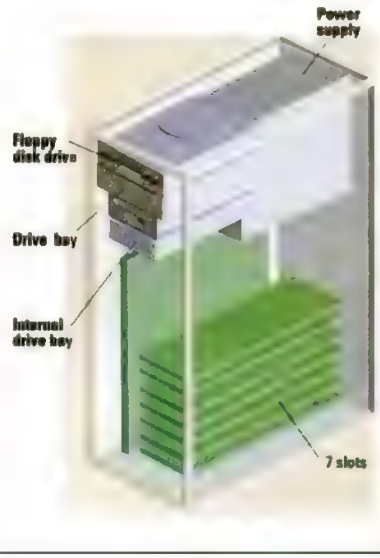
The Media Micro Pro425SI

FACT FILE

Media Micro Pro425SI

Media Micro Inc., 2109 O'Toole Ave., Suite Q, San Jose, CA 95131; 800-862-1800

List price (tested configuration): $1,799.
Memory and processor RAM cache: 4MB 70-ns SIMMs, 256K cache.
Disk drives and controller: Conner 19-ms 212MB IDE hard disk, Microwise controller, 1.2MB and 1.44MB floppy disk drives.
Display: Diamond 1,024-by-768 adapter with 1MB RAM, ADI 14-inch monitor, 60-Hz refresh rate.
Software: DOS 5.0, Microsoft Windows 3.1.
In short: Although the best thing the Media Micro Pro425SI has going for it is an appealing case design, its low price can't be ignored, either.
501 ON READER SERVICE CARD



The Monitors for Windows

The ViewSonic 7 was the original, "Big Screen for Windows" monitor. Here's what some editors said about it:

*Byte (May 1992) "... **The ViewSonic 7 gets our vote as the best overall monitor**".*

*Windows Magazine (May 1992) "... **The ViewSonic 7 is the best value in the test**".*

*Infoworld (Sept 1991) "... **The ViewSonic 7 captured the top spot in our tests**".*

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CIRCLE 118 ON READER SERVICE CARD

scores of other uncached disk controllers, and the Tseng-based adapter was not designed for Windows graphics.

The functional design of the Media Micro system itself is appealing. Its easily accessed motherboard and easy-care construction make it the kind of purchase that PC resource people appreciate. The HyQuest motherboard has just enough expansion possibilities to keep pace with current applications, and the UMC chip set gives it some room to grow with changing needs.

Media Micro backs this unit with a five-year warranty on labor and a one-year warranty on parts that eliminates the need for extended contracts. Media Micro does not offer on-site service but cross-ships parts and accepts units for repair. Technical support, available weekdays and Saturdays, is not toll free but is handled on a call-back basis. A 24-hour BBS downloads information.—*GP*

Mega Computer Systems

Mega Impact 486SX/25E+

Because of its high disk score and eight drive bays, the Mega Impact 486SX/25E+ is a sure candidate for server use. Like its cousin, the Mega Impact 486/50E (reviewed in *PC Magazine,* June 16, 1992), this $2,995 EISA tower showed good performance on all our tests except DOS video, which its S3-accelerated graphics card was not designed to handle.

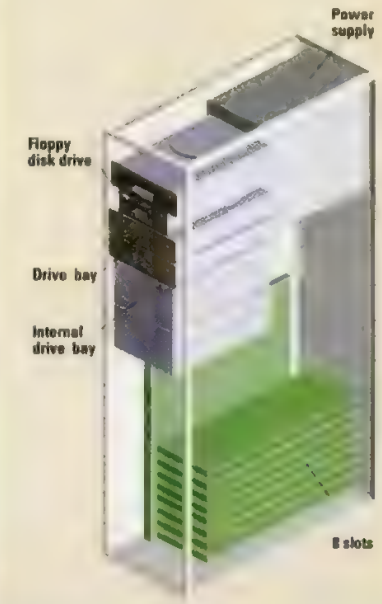
The Mega Impact arrived with 4MB of RAM (expandable to 64MB), a Micropolis 14-millisecond 340MB SCSI-2 hard disk boosted by a 32-bit DTC 3290AS EISA controller with 4MB of RAM, and DOS 5.0. The BCM motherboard carries an AMI BIOS and an Intel chip set; BCM discrete logic controls the 256K secondary cache. An OverDrive socket and a 486SX in a standard socket are located on a plug-in card that goes into a proprietary 32-bit slot. Of the six EISA slots, three contain cards for I/O, the hard disk, and video; a 16-bit ISA goes unused. Four accessible 5.25-inch bays are at the top; one 5.25-inch and three 3.5-inch internal bays rest beneath them.

The Mega Impact 486SX/25E+

FACT FILE

Mega Impact 486SX/25E+
Mega Computer Systems (a division of Mega Computer Corp.), 10840 Thornmint Rd., San Diego, CA 92127; 800-662-7775, 619-487-8888; fax, 619-485-1518

List price (tested configuration): $2,995
Memory and processor RAM cache: 4MB 70-ns SIMMs, 256K cache.
Disk drives and controller: Micropolis 14-ms 340MB SCSI-2 hard disk, DTC controller, 4MB cache, 1.2MB and 1.44MB floppy disk drives.
Display: Prolink 1,024-by-768 adapter with 1MB RAM, Mega 14-inch monitor, 60-Hz refresh rate.
Software: DOS 5.0.
In short: The Mega Impact 486SX/25E+ made no major impact in terms of performance or service, though its large number of drive bays and EISA motherboard make it eligible for server use.
502 ON READER SERVICE CARD



The Mega Impact generated an excellent disk score: well above average, it placed fourth among the disk scores of the 58 machines tested. The Graphics Winmark score was also considerably above average. Processor and memory scores came in at just a shade above average—a very respectable turnout.

The construction of this standard tower system seemed good, but the system's documentation was incomplete, covering only information on the BCM motherboard and the Prolink video adapter. Mega Computer Systems sells both direct and through dealers. It offers a one-year parts-and-labor warranty; on-site service and an extended service contract are pending. The company's toll-free service and support line is open 8:30 to 5:30 weekdays Pacific time.—*CNC*

Memorex Telex Corp.

Memorex Telex 8080-25

Look, no screws. Getting inside the $2,545 small-footprint Memorex Telex 8080-25 is as easy as pressing in two no-tool clips. Once you have the casing off, though, you will find a bit less reason to be excited.

Inside, you'll find a Cache Computers motherboard with an AMI BIOS and a UMC chip set, a UMC cache controller, and a 64K direct-mapped, write-back cache. You can expand the unit's 4MB of RAM to 32MB on the motherboard, and a proprietary 32-bit expansion card carries system memory to a 64MB maximum. If you fill the SIMMs sockets to capacity, however, you may have to forgo putting any full-length add-in cards into

The Memorex Telex 8080-25

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PC MAGAZINE "BEST of 1991" ROBERT KENDALL PRO AUDIO SPECTRUM REVIEW 7/14/91

PC Multimedia PC

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CIRCLE 093 ON READER SERVICE CARD

three of the seven 16-bit ISA slots. The 486SX is mounted in a standard socket on the motherboard; nearby is a Weitek socket, but a 487/OverDrive socket is nowhere to be found. Access to the Weitek socket is partially hindered by the ribbon cables that lead to the hard disk. Rumor has it that there's a 213MB Maxtor hard disk down there, but you will have to dig under the power supply if you want to find it.

In a sea of near-identical processor scores, the Memorex Telex managed to just keep its nose above water. The memory score was below average. At the same time, the memory score was not out of line with that of the other systems in this review configured with 64K processor RAM caches.

The score for the Maxtor hard disk was below average—in line with those of other uncached disk controllers. We were unimpressed with its video performance, which was determined by the non-accelerated ATI 2880-5 graphics adapter. Further compromising its video performance is the 14-inch Memorex Telex monitor, which outputs 800-by-600 resolution at a slow and flickering 56-Hz vertical refresh rate.

The documentation is relatively light for this computer, so don't expect the full line of system diagrams that you might be used to. To improve on the system itself, there are optional RAM caches: A 128K cache costs $60, and a 256K cache will cost you $116.

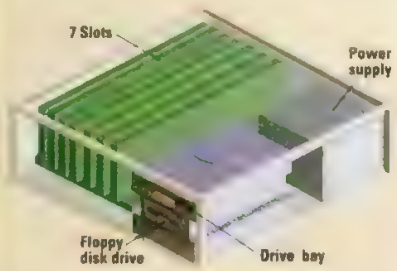
Memorex Telex Corp. offers a standard one-year warranty on parts and labor and provides its own on-site service at a percentage of the configuration price. Toll-free technical support is available 24 hours a day.—*BG*

FACT FILE

Memorex Telex 8080-25

Memorex Telex Corp., 545 E. John Carpenter Freeway, Irving, TX 75062; 800-944-4455, 214-444-3586; fax, 214-444-3500

List price (tested configuration): $2,545
Memory and processor RAM cache: 4MB 70-ns SIMMs, 64K cache
Disk drives and controller: Maxtor 15-ms 213MB IDE hard disk, 32K buffer, 1.2MB and 1.44MB floppy disk drives
Display: ATI 1,204-by-768 adapter with 1MB RAM, Memorex Telex 14-inch monitor, 56-Hz refresh rate
Software: DOS 5.0, Microsoft Windows 3.1.
In short: Other than the easy-open case, the Memorex Telex 8080-25 is average in price and performance
503 ON READER SERVICE CARD



Micro Express

ME 486SX/Local Bus/25

Micro Express's entry is erratic in more ways than one. Its engineering ranged from cutting edge to substandard, as did its choice of components. The unit's $1,866 price is good, but not the best in the low-cost ISA-based category. Lastly, our first test unit had a motherboard failure, and the replacement's monitor died after three days.

The mini-tower case is of decent enough quality and holds four front-accessible drive bays, one internal drive bay, and a 200-watt power supply. But it's the Ergon MBC1013 motherboard that will draw your attention. It has an ETI/Phoenix BIOS, an OPTi/Chips and Technologies chip set, and a 486SX processor in a 240-pin ZIF (zero-insertion-force) socket (it has an extra row of pins), ready to support Intel's next generation of CPU (the 586). The 4MB of on-board system RAM (expandable to 32MB) is backed by 256K of direct-mapped, write-back cache, also available in 64K or 128K sizes.

The ME 486SX/Local Bus/25

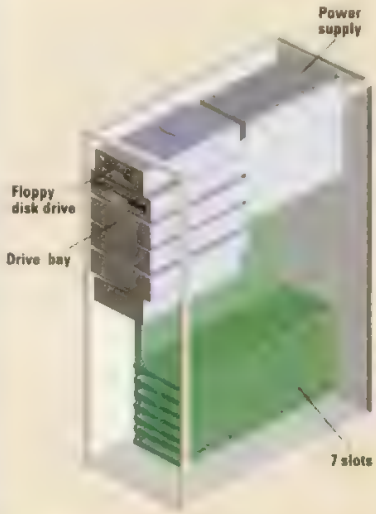
As you scan this motherboard, you'll suddenly notice an engineering burst from Micro Express in the form of a local-bus video solution based around a Tseng ET4000 chip set with 1MB of dedicated RAM. A Quantum 240AT 240MB IDE hard disk is integrated onto the motherboard, as are all the I/O and floppy disk interfaces—leaving all seven ISA slots free. Though the Tseng local-bus implementation can handle up to 1,024-by-768 resolution at VESA-compliant rates, it's

FACT FILE

ME 486SX/Local Bus/25

Micro Express, 1801 Carnegie Ave., Santa Ana, CA 92705; 800-989-9908, 714-852-1400; fax, 714-852-1225

List price (tested configuration): $1,866
Memory and processor RAM cache: 4MB 70-ns SIMMs, 256K cache
Disk drives and controller: Quantum 16-ms 240MB IDE hard disk, 256K cache, 1.2MB and 1.44MB floppy disk drives
Display: 1,024-by-768 local-bus video with 1MB RAM integrated on motherboard, Micro Express 14-inch monitor, 70-Hz refresh rate
Software: DOS 5.0, Microsoft Windows 3.1.
In short: The ME 486SX/Local Bus/25 is a low-cost PC with erratic performance and components. Our test unit suffered two failures
504 ON READER SERVICE CARD



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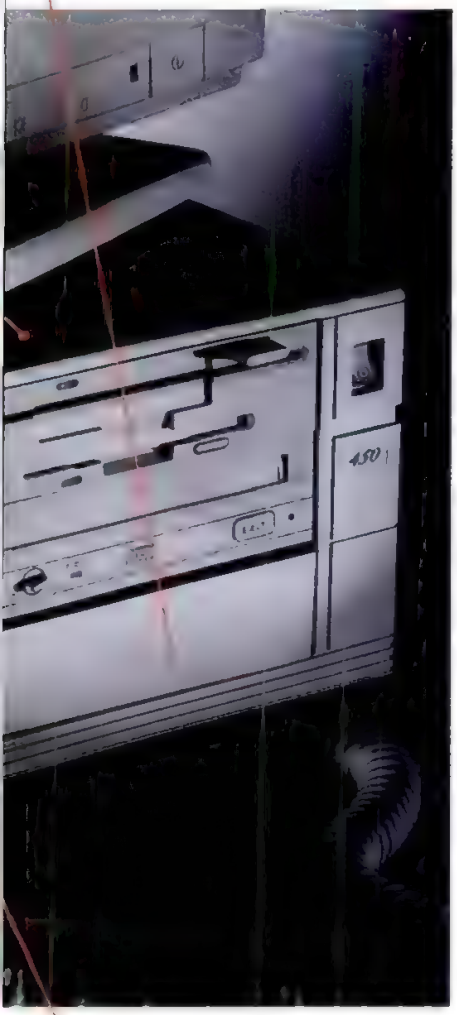

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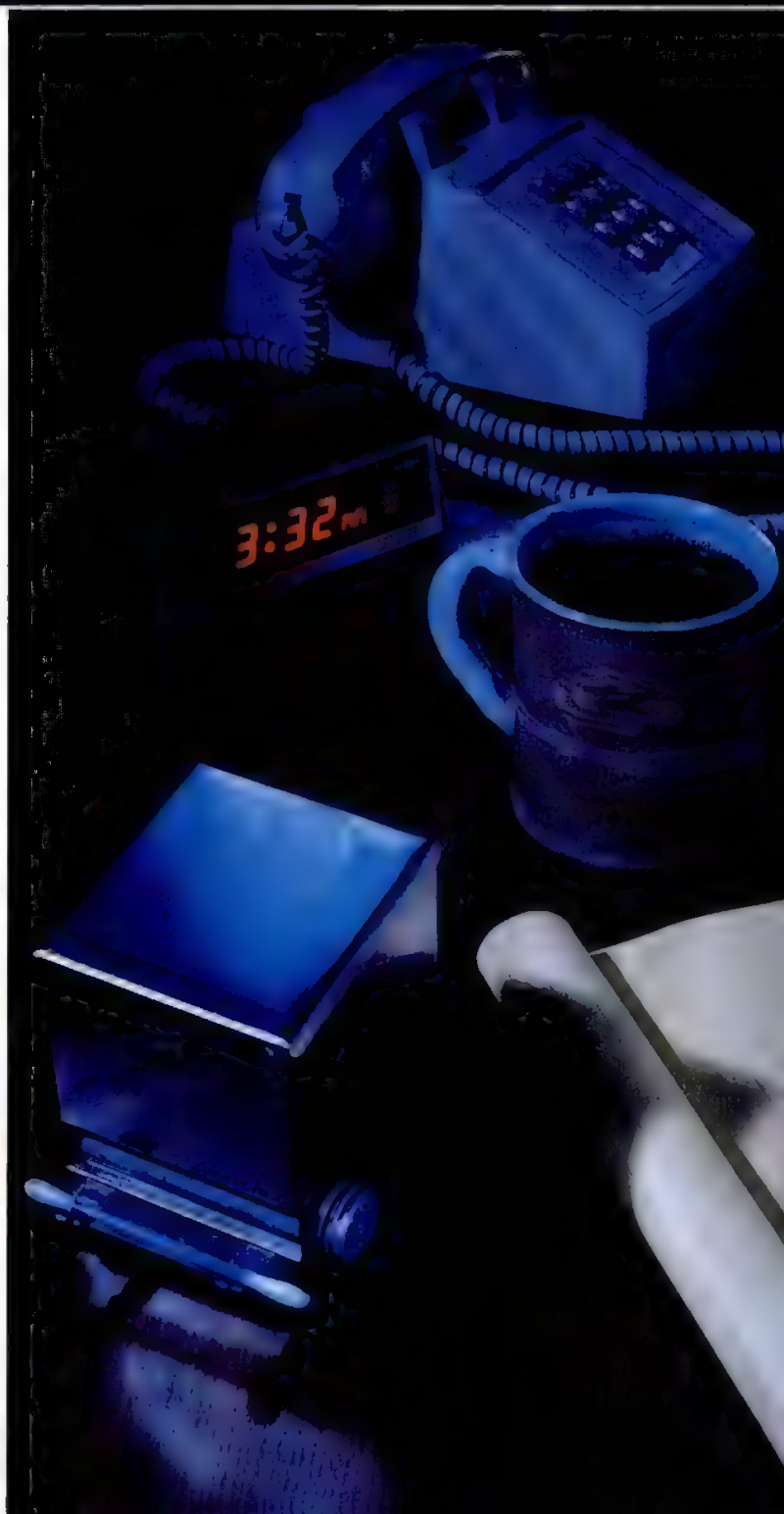


unfortunately mismatched with a proprietary Micro Express monitor that can reach only 800-by-600.

At that resolution, however, the local bus handed in the top DOS video score, as well as very respectable Windows performance. The Quantum hard disk would have done better with an external cache, but it didn't do badly. With the 256K processor RAM cache, its processor benchmark test score was competitive.

Looking at the whole package, including the two-year warranty (except for one year on the hard disks), it's not a bad deal. On-site service from GE Computer Services costs 8 percent of the system price; the toll-free technical-support line is open 24 hours a day. But with the erratic hardware quality PC Magazine Labs saw, you would be better off with slightly slower video under DOS and a more dependable unit—such as the Lightning Omniflex 486SX25, which costs $200 less.—*OR*

Micro Generation

Micro Generation LB-25SX

With its local-bus video, I/O, and above-average monitor, the $2,395 Micro Generation LB-25SX is an interesting entry, but priced somewhat higher than other ISA-based systems that deliver less stellar engineering but similar performance.

The standard small-footprint case holds five bays (one is internal). The High Candor G486PLB motherboard has a 256K direct-mapped, write-back cache run by an OPTi controller and 4MB of RAM (expandable to 32MB). Its one shortcoming is the lack of an OverDrive socket. With the circuitry for the IDE and floppy disk drives on the motherboard, seven of the eight ISA slots are free.

Card-mounted local-bus video, the main interest in this system, occupies one of the two proprietary slots on the motherboard. Made by High Candor, the G-Host S3 Plus video adapter also holds all of the I/O interfaces, the S3 accelerator chip, and 1MB of video RAM. Fortunately, the card is allowed to show its stuff on a 15-inch MAG MX15H multiscanning monitor. This very-high-quality display has front-mounted digital controls, an LED mode indicator, and 1,280-by-1,204 resolution at a 70-Hz refresh rate.

Except for its excellent Graphics Winmark result, performance was average. The processor score was competitive; memory, a shade below that. The disk score was below average; video was typical of S3: excellent graphics, slow DOS.

Micro Generation's one-year warranty is standard except for excluding damages incurred during transportation. TRW provides on-site service free the first year. Technical support is available at an 800 number.—*OR*

The Micro Generation LB-25SX

FACT FILE

Micro Generation LB-25SX

Micro Generation (a division of Continental Technology Inc.), 300 McGraw Dr., Edison, NJ 08837; 800-872-2841, 908-225-8899; fax, 908-225-8999

List price (tested configuration): $2,395

Memory and processor RAM cache: 4MB 70-ns SIMMs, 256K cache

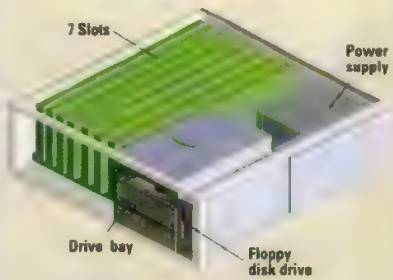
Disk drives and controller: Western Digital 14-ms 210MB IDE hard disk, 64K buffer, 1.2MB and 1.44MB floppy disk drives.

Display: 1,024-by-768 VESA-compliant local-bus video on proprietary adapter with 1MB RAM, MAG 15-inch monitor, 70-Hz refresh rate

Software: DOS 5.0 or DR DOS 6.0, Microsoft Windows 3.1; choice of BCIM (Business Contact Information Management), NewWave 3.0, The Norton Desktop for Windows, or PC Globe

In short: With high-quality components and local-bus video, the Micro Generation LB-25SX tries to be low-cost and high-tech at the same time. Unfortunately, its performance was no better than that of the other reviewed machines, and it has one of the higher price tags

505 ON READER SERVICE CARD



Mitsuba Corp.

Mitsuba Professional Upgradable

At $2,850, the Mitsuba Professional Upgradable is a good buy for an EISA-based small-footprint desktop that includes a zippy 4MB caching disk controller, 4MB of RAM, a 213MB Conner hard disk, and a modular CPU design. DOS and Microsoft Windows are not included, however, and the Mitsuba video adapter, which is an OEM from Tseng, is not designed for Windows-intensive use.

The case contains four drive bays, three of which are accessible. Its Mitsuba SE 2000 motherboard has an AMI BIOS and an Intel chip set. Slots number six EISA, one ISA, and a proprietary CPU. An upgrade module that fits into the proprietary slot holds a 486SX in a standard socket, but unfortunately lacks an OverDrive socket. The system carries 128K of direct-mapped, write-back cache (ex-

The Mitsuba Professional Upgradable

pandable to 256K) controlled by an Intel cache controller, also on the processor module. Mitsuba Corp. uses its own Tseng-based 1,024-by-768 video adapter, which it pairs with a 14-inch Mitsuba 710VX 1,024-by-768 monitor with a 70-Hz refresh rate. Apart from the processor card, the total card count consists of a 1MB Tseng ET4000AX adapter, a 4MB Alpha Research EISA-IPG caching disk controller, and an I/O card, leaving four nonproprietary slots free.

While its memory score was average, the Mitsuba Professional yielded the highest disk score on our test, thanks to its Alpha Research EISA/IDE caching disk controller with 4MB of RAM. The Tseng video adapter turned in an above-average DOS video score; it is not designed for Windows graphics.

Mitsuba backs the Mitsuba Professional for one year on parts and labor, one-way shipment paid. Technical support is free but the company does not pay for the call.—*SGT*

Myoda Computer Centers Inc.

Myoda 486SX-25b

The $1,799 ISA-based Myoda 486SX-25b, which came to us with 4MB of RAM (expandable to 32MB), a 212MB Maxtor hard disk, DOS 5.0, and Microsoft Windows 3.1, featured an excellent monitor. A positive overall effect, however, was offset by some design quirks.

The small-footprint cabinet has five drive bays, all accessible. The motherboard carries an AMI BIOS, an ETEQ chip set, a 486SX mounted in a standard socket, and a 256K direct-mapped, write-back cache managed by an ETEQ controller. No OverDrive socket compromises system upgradability. The Maxtor LXT213A IDE hard disk was run by an uncached Chicony CH-101-B controller.

A Diamond SpeedSTAR video adapter, based on a Tseng ET4000 chip with 1MB of RAM, is paired with a 14-inch Sony CPD 1304S monitor that outputs 1,024-by-768 resolution at 70 Hz. This monitor, on the whole, was the stand-out portion of the system, supplying a beautifully crisp picture. The video card and an I/O card fill two 16-bit slots; four 16-bit and two 8-bit slots are free.

The Myoda arrived from the manufacturer set for 12.5-MHz operation on its ISA expansion bus. Since we were unable to set it to our standard 8-MHz testing speed—the speed at which most I/O buses run—we ran our performance tests at 6.25 MHz to ensure compatibility. Moreover, the system needed to be set for three read states and two write wait states in order to operate. While its processor performance was average and its DOS-based video good, these factors slowed down its performance on other tests.

The Myoda suffered from other problems as well. It needed to be switched on and off several times before it would boot; no cause was found. The hard disk was mounted improperly; the power supply and drive cables made access to the SIMMs difficult.

You can extend the one-year parts-and-labor warranty an additional year for 7 percent of the list price. Technical support is available via a toll call. Service is performed at the factory or by a distributor, and on-site service is optional.—*AG*

The Myoda 486SX-25b

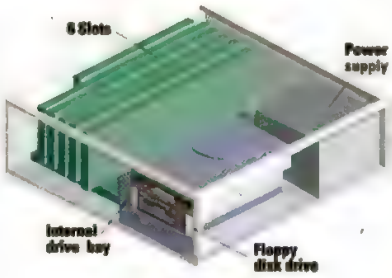
FACT FILE

Mitsuba Professional Upgradable

Mitsuba Corp., 1925 Wright Ave., La Verne, CA 91750; 800-648-7822, 714-392-2000; fax, 714-392-2021

List price (tested configuration): $2,850.
Memory and processor RAM cache: 4MB 70-ns SIMMs, 128K cache.
Disk drives and controller: Conner 18-ms-213MB IDE hard disk, Alpha Research controller, 4MB cache, 1.2MB or 1.44MB floppy disk drive.
Display: Mitsuba 1,024-by-768 adapter with 1MB RAM, 14-inch Mitsuba monitor, 70-Hz refresh rate.
Software: None.
In short: An expensive buy, the Mitsuba Professional Upgradable includes a zippy 4MB hard disk caching controller, but no software.

506 ON READER SERVICE CARD



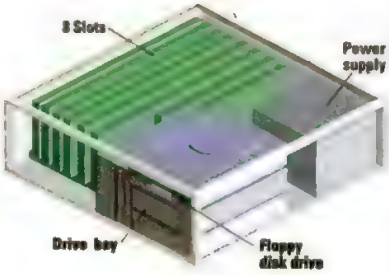
FACT FILE

Myoda 486SX-25b

Myoda Computer Centers Inc., 1070 N. Roselle Rd., Hoffman Estates, IL 60195; 800-284-7746, 708-885-7337; fax, 708-885-7373

List price (tested configuration): $1,799.
Memory and processor RAM cache: 4MB 70-ns SIMMs, 256K cache.
Disk drives and controller: Maxtor 15-ms 212MB IDE hard disk, 32K buffer, Chicony controller, 1.2MB and 1.44MB floppy disk drives.
Display: Diamond 1,024-by-768 adapter with 1MB RAM, Sony 14-inch monitor, 70-Hz refresh rate.
Software: DOS 5.0, Microsoft Windows 3.1.
In short: Though the Myoda 486SX-25b isn't unpleasant to use, substandard construction and nonstandard settings make us hesitant to recommend it.

525 ON READER SERVICE CARD



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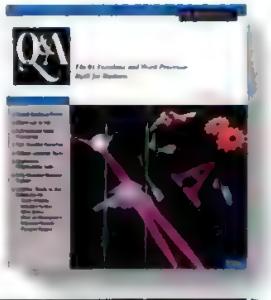

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National Micro Systems Inc.

Flash 486SX-25C

The $1,999 Flash 486SX-25C is a small-footprint desktop PC offering good performance at a competitive price. Similar in features to the Poly 486SX-25Y, it costs nearly $400 less. All told, its components go a long way for the money.

Our test unit had 4MB of RAM (with a 64MB system maximum), 256K of direct-mapped, write-back RAM cache with a UMC cache controller, and a 213MB Maxtor hard disk. The AIR motherboard sports an AMI BIOS, a UMC/Chips and Technologies chip set, a 486SX in a standard socket, and a 80487 coprocessor/OverDrive socket.

The video adapter, caching disk controller, and I/O card left four out of seven 16-bit slots and one 32-bit slot empty. Five drive bays (three half-heights and two slimlines) are accessible. Unfortunately, the layout is messy. Putting the SuperIDE controller card into slot 5 makes for wiry chaos. The memory banks are difficult to reach, and the CPU is partially covered by the drive bays housing the hard disk and 1.44MB floppy disk drive.

What surfaced from the disorder of internal components, though, was respectable performance. The 256K cache produced an above-average processor score; the memory score wasn't as good but still ranked within the average range. The Promise SuperIDE caching disk controller with 512K of cache pulled down a relatively high disk score, but the same card in the Polywell system showed what could be achieved with 1MB of disk cache. The Orchid Fahrenheit video adapter, bolstered by an S3 chip set, produced an exceptional Graphics Winmark score.

The documentation left a bit to be desired. Besides erroneously labeled diagrams, it included instructions for AIR's AVIEW2/2G video adapter rather than the Orchid adapter that was installed. Such small glitches do not mar the overall quality of the Flash 486SX-25C, however.

The warranty on this system covers parts for 15 months and labor for 2 years. National Micro Systems provides on-site service for $75 a year; the toll-free technical-support line handles calls weekdays from 9:00 to 5:30 eastern time.—*BG*

The Flash 486SX-25C

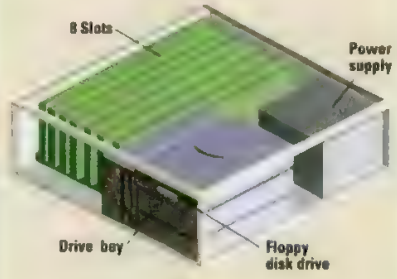
FACT FILE

Flash 486SX-25C

National Micro Systems Inc., 2979-B Pacific Dr., Norcross, GA 30071; 800-642-7649, 404-446-0520; fax, 404-449-5297

List price (tested configuration): $1,999.
Memory and processor RAM cache: 4MB 70-ns SIMMs, 256K cache.
Disk drives and controller: Maxtor 15-ms 213MB IDE hard disk, Promise Technology controller, 512K cache, 1.2MB and 1.44MB floppy disk drives.
Display: Orchid 1,024-by-768 adapter with 1MB RAM, Addonics 14-inch monitor, 72-Hz refresh rate
Software: DOS 5.0, Microsoft Windows 3.1.
In short: The Flash 486SX-25C seems awkwardly configured but is a solid performer for the money.

508 ON READER SERVICE CARD



NCR Corp.

NCR System 3335

Along with IBM's PS/2 Model 95 XP 486SX/25, NCR Corp.'s $5,570 NCR System 3335 stands out in this review because of its Micro Channel architecture—and because of its healthy price tag. The NCR system uses decent construction and components, some proprietary to NCR, but the combination provides only mediocre performance.

A short small-footprint case leaves little room for expansion. In front of the 215-watt power supply are only two accessible bays (one filled); the internal bay already contains the Maxtor 213MB SCSI-2 hard disk.

The motherboard doesn't leave much room for free expansion either—"free" meaning any third-party MCA card. The NCR requires three of the six available 10-MHz MCA bus slots to be proprietary: two for memory and one for the SCSI controller. A few niceties have been observed, however, including flash BIOS, integrated I/O ports, and an OverDrive upgrade socket. On the other hand, a secondary processor RAM cache is lacking. Video and the hard disk controller are NCR's own, and neither lives up to its full potential. Though the SCSI is a 32-bit solution, it lacks a cache; and, while NCR's video has decent enough capabilities, it is attached to an NCR monitor that isn't ergonomically appealing and can display only 800-by-600 resolution.

The drawbacks of this haphazard design become evident when tested. Though its processor score was decent, memory scores fell somewhat, due to the missing processor RAM cache. The 32-bit SCSI hard disk should have soared with the eagles, but instead plodded along with the middling rest of the pack. Though the NCR's video card could have had some proprietary advantages, it

The NCR System 3335

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NCR System 3335

NCR Corp. (the Networked Computing Resource of AT&T), 1700 S. Patterson Blvd., Dayton, OH 45479; 800-225-5627, 513-445-5000

List price (tested configuration): $5,570

Memory and processor RAM cache: 4MB 80-ns SIMMs

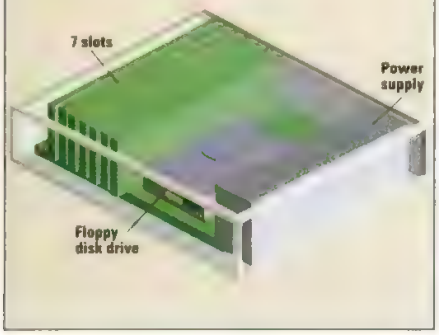
Disk drives and controller: Maxtor 15-ms 213MB SCSI-2 hard disk, 32K buffer, NCR controller, 1.2MB and 1.44MB floppy disk drives.

Display: 1,024-by-768 video with 1MB RAM integrated on motherboard, NCR 14-inch monitor, 56- to 72-Hz refresh rate

Software: None

In short: The MCA-bus NCR System 3335 has a high list price, solid components, and, despite custom video and disk drive controllers, mediocre performance.

509 ON READER SERVICE CARD



turned in unremarkable performance.

Considering the size of the company behind the System 3335, you'd expect above-average customer support—no such luck. A typical one-year parts-and-labor warranty accompanies this unit and that's all; there's no free first-year on-site service and no toll-free technical support. However, NCR typically sells into large accounts, and customers have considerable flexibility negotiating service and support programs.—*OR*

NEC Technologies Inc.

NEC PowerMate 486SX/25i

NEC Technologies' 25-MHz 486SX is another medium-cost ISA-based PC that relies on its manufacturer's name and reputation in order to sell. But although the $3,298 NEC PowerMate 486SX/25i has a number of nice-to-see features, it

The NEC PowerMate 486SX/25i

has more bumps and rough edges than its most immediate competitor, the Dell System 486D/25.

The PowerMate's standard desktop case—all plastic with a no-tools entry design—offers only four drive bays, with only one left free. On the other hand, that may be all the system can handle because it runs on a 110-watt power supply with three connectors. However, components draw less power each year, so 110 watts may be adequate for small-footprint PCs.

The NEC's motherboard uses a Phoenix flash BIOS, boasts a 487/OverDrive upgrade socket, and two clock crystals (50 MHz and 66 MHz). It also carries all I/O and disk controller circuitry as well as a local-bus video solution based around a Tseng ET4000 chip set. This integrated design allows the NEC to install only four expansion slots positioned perpendicular to the motherboard.

The 4MB to 36MB of system RAM come aided by a 128K processor RAM cache, and the unit's hard disk is the justly popular 245MB IDE Quantum ProDrive with its speedy 256K cache. If you choose to install all eight SIMM chips, however, you may not be able to use the last expansion slot.

The local-bus video subsystem displays onto a high-quality 15-inch NEC MultiSync 4FG monitor, complete with a low-emission rating and ergonomically positioned digital controls. As you would expect, the options are plentiful, and NEC's system documentation is competent (though, surprisingly, it is a little thin).

On PC Magazine Labs' benchmark tests, the PowerMate turned in average processor and hard disk scores, but mem-

FACT FILE

NEC PowerMate 486SX/25i

NEC Technologies Inc., 1414 Massachusetts Ave., Boxborough, MA 01719; 800-388-8888, 508-264-8000; fax, 708-860-7973

List price (tested configuration): $3,298.

Memory and processor RAM cache: 4MB 80-ns SIMMs, 128K cache.

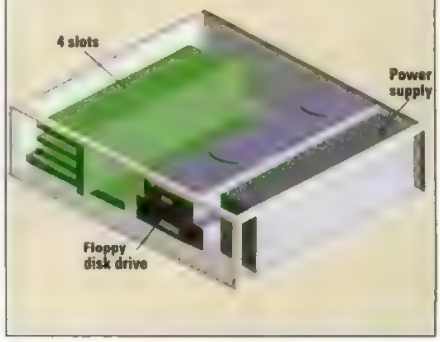
Disk drives and controller: Quantum 16-ms 245MB IDE hard disk, 256K cache, 1.2MB and 1.44MB floppy disk drives

Display: 1,024-by-768 local-bus video with 1MB RAM integrated on motherboard, NEC 15-inch monitor, 70-Hz refresh rate.

Software: DOS 5.0, Microsoft Windows 3.1.

In short: The NEC PowerMate 486SX/25i may not have the best price tag here, and it does suffer from some performance dips, but it's got NEC's name. That may be enough reason to buy this machine, but you really should check out some other brands first.

510 ON READER SERVICE CARD



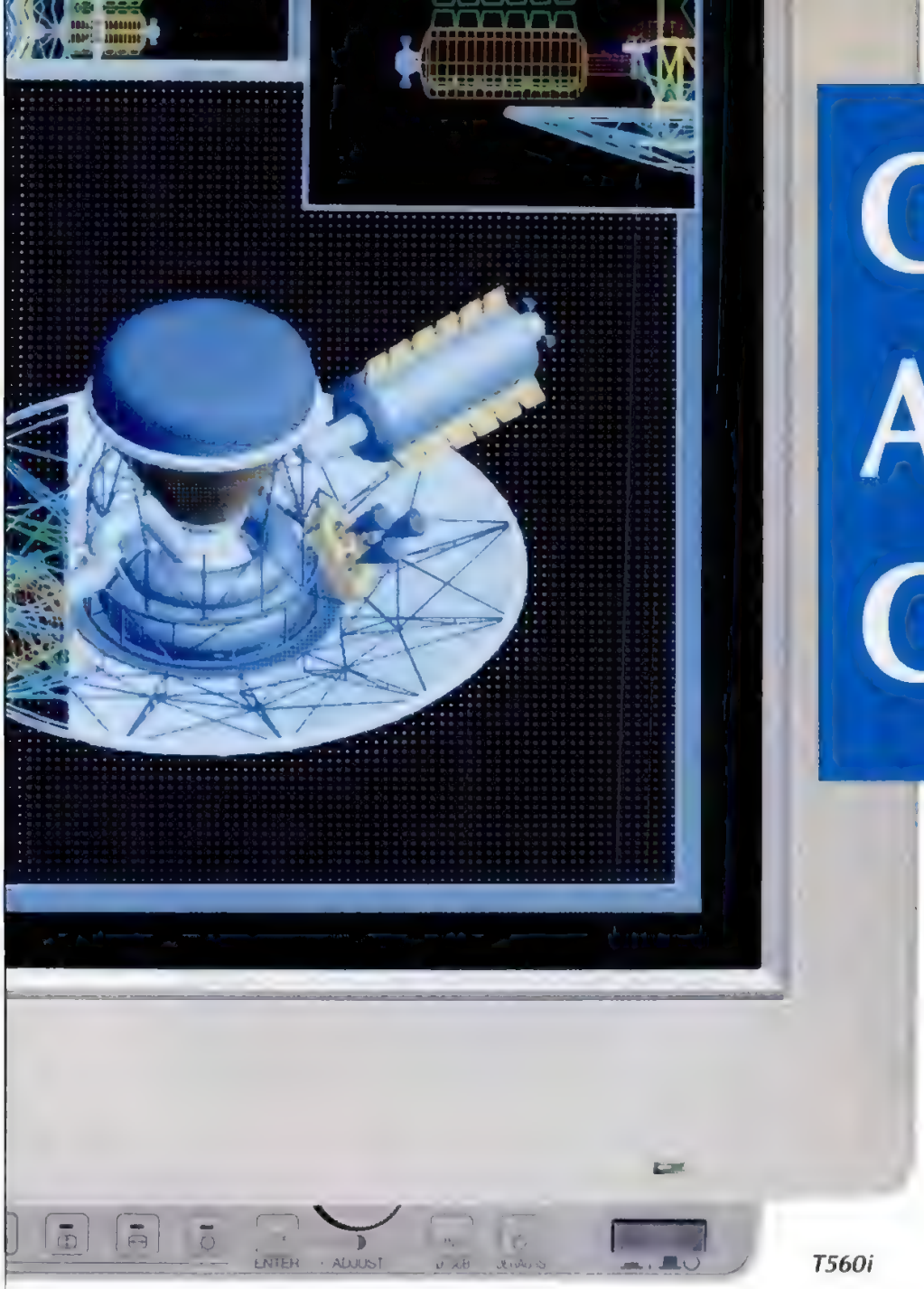
ory numbers were low. Its score on our DOS-based video test was excellent, but its Graphics Winmark results were subpar due to NEC's choice of the Tseng ET4000 chip set. NEC's warranty is competitive: one year on parts and labor and free on-site service, backed by toll-free technical support.—*OR*

NETiS Technology Inc.

NETiS ISA 425SX

With a good component mix in its small-footprint case, the $1,699 NETiS ISA 425SX gave us performance typical of low-end machines. But with a price this low, it's worth checking to see how well the unit's strengths match your needs.

The NETiS is a standard eight-slot 16-bit ISA machine with six open slots. Our test unit had 4MB of RAM (expandable



T560i

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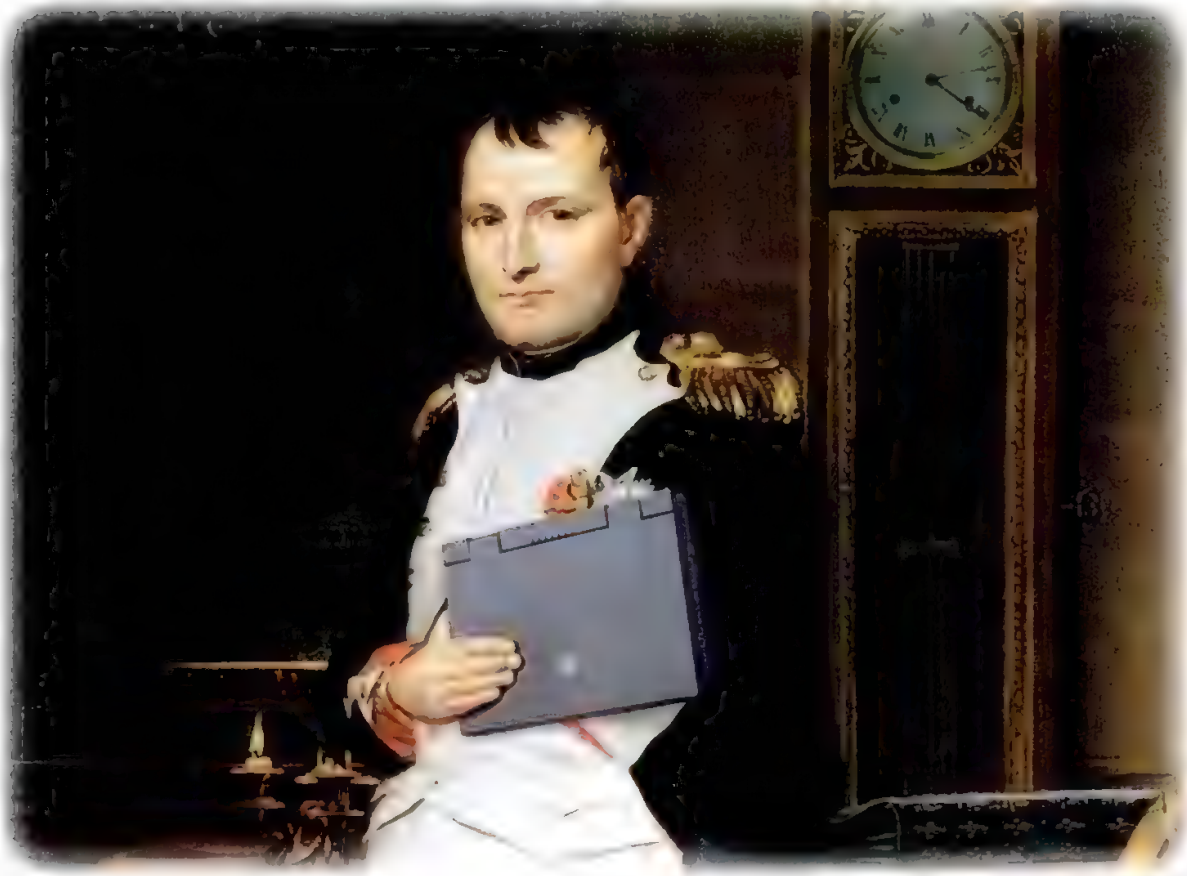

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to 32MB), a 64K direct-mapped, write-back cache, and a 212MB Conner IDE hard disk. Its Free Technology motherboard holds an AMI BIOS, an OPTi chip set and caching controller, a 486SX in a standard socket, and a combination 80487 coprocessor and OverDrive socket. The video subsystem pairs the Orchid ProDesigner IIs with a ViewSonic monitor. All the PC's components are packed in a chassis that holds up to five drives: four accessible and one internal.

The NETiS ISA 425SX

The NETiS showed its best performance on the disk test. Its Promise Technology controller with a 2MB RAM cache worked well with the 16-millisecond Conner hard disk to produce better-than-average times, ranking eleventh among the test units. As with nearly a third of the systems reviewed here, processor and memory performance suffered from the small secondary cache. True to form, the ET4000-based ProDesigner turned in good DOS video results but low Graphics Winmark scores.

NETiS Technology grants a basic one-year parts-and-labor warranty with no extension contracts. On-site service from the company costs $60 more, but most repair work requires shipping the system to the West Coast. Technical questions are handled by long-distance calls to the support line weekdays from 9:00 to 5:00 Pacific time.—*GP*

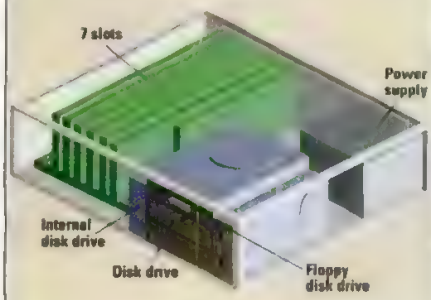
FACT FILE

NETiS ISA 425SX

NETiS Technology Inc., 1606 Centre Pointe Dr., Milpitas, CA 95035; 408-263-0368; fax, 408-263-4624

List price (tested configuration): $1,699
Memory and processor RAM cache: 4MB 70-ns SIMMs, 64K cache
Disk drives and controller: Conner 16-ms 212MB IDE hard disk, Promise Technology controller, 2MB cache, 1.2MB and 1.44MB floppy disk drives.
Display: Orchid 1,024-by-768 adapter with 1MB RAM, ViewSonic 14-inch monitor, 60-Hz refresh rate
Software: DOS 5.0 or DR DOS 6.0, Microsoft Windows, Version 3.1.
In short: The NETiS ISA 425SX benefits from a good caching disk controller but does not really distinguish itself in terms of price or performance.

511 ON READER SERVICE CARD



Northgate Computer Systems Inc.

Northgate Elegance ZXP

The Northgate Elegance ZXP is a sound machine. Our $2,649 test unit was rich with features, including 4MB of RAM (expandable to 32MB) and a 234MB Quantum hard disk, though its 64K secondary cache proved too little to make it an outstanding performer. If you can get by on slightly slower performance, this is an attractive machine, although pricier than much of the direct-market competition.

The Elegance ZXP came ready to go. The documentation was thorough and plentiful; Windows 3.1 drivers were in place to drive the Orchid Fahrenheit 1280 video adapter; and the guts of the machine were intelligently put together. Inside this small-footprint desktop there's a lot to like.

The Mylex motherboard has a Mylex BIOS, an OPTi chip set, and an OPTi cache controller. One 16-bit ISA slot holds the video adapter, leaving five others and one 8-bit slot free. Five drive bays (three 5.25-inch and two 3.5-inch) are accessible from the front; best of all, the 486SX is nestled in a ZIF (zero-insertion-force) socket for simple upgrades.

As mentioned, the mere 64K secondary cache caused the Elegance ZXP to lag behind the competition in processor and memory scores. Northgate Computer Systems assures us that 128K and 256K caches are available, which may be all the performance boost you need. With 256K of read/write cache and IDE con-

The Northgate Elegance ZXP

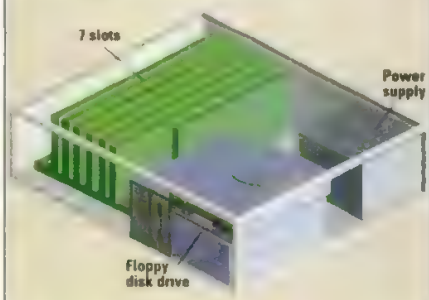
FACT FILE

Northgate Elegance ZXP

Northgate Computer Systems Inc., 1075 Flying Cloud Dr., Eden Prairie, MN 55344; 800-548-1993, 612-943-8181; fax, 612-943-6960

List price (tested configuration): $2,649
Memory and processor RAM cache: 4MB 70-ns SIMMs, 64K cache
Disk drives and controller: Quantum 16-ms 234MB IDE hard disk, 256K cache, 1.2MB and 1.44MB floppy disk drives
Display: Orchid 1,024-by-768 adapter with 1MB RAM, Panasonic 14-inch monitor, 72-Hz refresh rate
Software: DOS 5.0, Microsoft Windows 3.1.
In short: The Northgate Elegance ZXP is well built and a pleasure to use—for the price

512 ON READER SERVICE CARD



trols on the motherboard, the 16-millisecond Quantum ProDrive brought in a respectable disk score. S3 chip–accelerated video on the Orchid Fahrenheit adapter won a good Graphics Winmark score; it was not designed for DOS video.

The system is rugged and well constructed. The Northgate OmniKey programmable keyboard is such a pleasure to use that it's almost reason enough to buy this unit. As far as options go, Northgate offers SCSI hard disks that range in capacity from 240MB to 1.2GB and four NEC monitors in place of the Panasonic that came with this unit.

Northgate backs the Elegance ZXP with a standard one-year warranty on parts and labor. The first year of on-site service, from NCR, is free; technical support is toll free 24 hours a day, 365 days a year.—*BG*

PCI Systems Inc.

PCI 486SX-25C256

Excellent support buttresses the PCI 486SX-25C256's solid performance across four out of five of our benchmark tests. The components are noteworthy, too: a PCI motherboard that holds up to 128MB of RAM and a Quantum 240MB SCSI-2 hard disk. DOS 5.0 and Microsoft Windows 3.1 are typically included in the $3,185 price, which is competitive for an EISA system.

With eight EISA slots—one holding the GTK AVGA-1024 video card with an ACU-MOS chip set, another the SCSI-2 adapter, and the third an I/O card—the PCI is a roomy small-footprint desktop. As long as the cards are not too large, slot expansion is assured: The video card, for example—which comes with 256K or 512K of video RAM—is half-height and half-length. The power supply blocks many of the SIMM sockets, however. All four bays—three 5.25-inch and one 3.5-inch—can be accessed from the front. A 486SX in a standard socket and a 487/OverDrive socket find room side by side on the OPTi motherboard, which has an AMI BIOS plus an OPTi chip set and cache controller.

Its video score was affected by both a smaller complement of video RAM (512K) and poor chip matching: Two chips ran at 80 nanoseconds and two at 100 ns. Still, its DOS-based video score was well above average. Though the unit's Graphics Winmark score was considerably below average, a different adapter would fix that. Processor performance was above average; disk and memory scores were average.

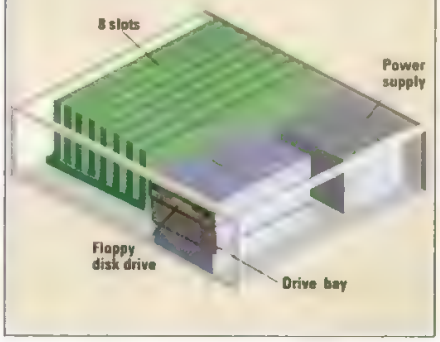
The PCI 486SX-25C256

FACT FILE

PCI 486SX-25C256
PCI Systems Inc., 5690 Sonoma Dr., Suite D, Pleasanton, CA 94566; 510-484-2818; fax, 510-484-3088

List price (tested configuration): $3,185
Memory and processor RAM cache: 4MB 70-ns SIMMs, 256K cache.
Disk drives and controller: Quantum 16-ms 240MB SCSI-2 hard disk, UltraStor controller, 1.2MB and 1.44MB floppy disk drives
Display: GTK 1,024-by-768 adapter with 512K RAM, Amazing Technologies 14-inch monitor, 60-Hz refresh rate
Software: DOS 5.0, Microsoft Windows 3.1.
In short: Though pricey, the PCI 486SX-25C256 boasts excellent service and support, along with solid performance on four of PC Magazine Labs' five benchmark tests

513 ON READER SERVICE CARD



A one-year parts-and-labor warranty accompanies the PCI, along with optional on-site service at $35 a year. An extended service contract, priced according to the configuration price, is available for up to three years. ComponentGuard, PCI Systems' service contractor, can be reached 24 hours toll-free.—*CNC*

Polywell Computers Inc.

Poly 486SX-25Y

Polywell Computers originally sent its $2,395 Poly 486SX-25Y to PC Magazine Labs with a 52-MHz clock crystal, allowing the unit to run at 26 MHz through the first round of benchmark tests. Since the LCD MHz indicator was also conveniently wired backwards, we almost didn't figure out what was wrong. Polywell said they had accidentally sent us one of a "bad batch" of crystals. We hope that was the case.

After retesting at 25 MHz, however, all we can say is that if Polywell did indeed attempt a little sleight of hand, they didn't have to. This is a well-constructed ISA-based system that performed competitively at 25 MHz and comes with a fair price as well.

The slightly downsized tower case is still quite roomy. It contains five accessible half-height bays (three 5.25-inch and two 3.5-inch), three internal 3.5-inch half-heights, and a 230-watt power supply with five connectors.

The Young Tech motherboard holds an AMI BIOS and a veritable buffet of processor sockets: 386, 387, 486, and 487 chips, configured via jumpers. The system comes with 4MB of RAM (expand-

The Poly 486SX-25Y

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able to 32MB) backed by a 256K secondary cache (which is fitting if you're thinking OverDrive). A 213MB Maxtor IDE hard disk holds an extra 64K read-ahead buffer and is hooked to a pass-through connector with 1MB of cache. A 1MB Orchid Fahrenheit 1280 video card with an S3 GUI accelerator is connected to a 14-inch ADI MicroScan 3E multiscanning monitor that can handle 1,024-by-768 resolution at 72 Hz. I/O isn't integrated, running off an 8-bit card that carries one parallel and two serial ports and one game port. At least the card is intelligently placed in the last slot so that cabling doesn't complicate further expansion.

The Poly's 25-MHz performance was high in almost every category. Processor and memory scores were both among the top five. The disk score was excellent, and the Orchid Fahrenheit board blasted through the Graphics Winmark test with another top-five entry. Only DOS video was a low score, as expected from the S3 GUI accelerator.

Polywell's warranty covers parts for five years and labor for two. We only wish this well-built system hadn't come with a pushed-clock crystal.—*OR*

▶ FACT FILE

Poly 486SX-25Y

Polywell Computers Inc., 61-C Airport Blvd., South San Francisco, CA 94080; 800-999-1278, 415-583-7222; fax, 415-583-1974

List price (tested configuration): $2,395

Memory and processor RAM cache: 4MB 60-ns SIMMs, 256K cache.

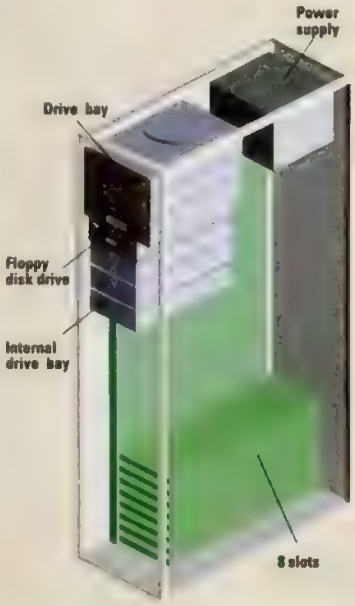
Disk drives and controller: Maxtor 15-ms 213MB IDE hard disk, 64K buffer, Promise Technology controller with 1MB cache, 1.2MB and 1.44MB floppy disk drives.

Display: Orchid 1,024-by-768 adapter with 1MB RAM, ADI 14-inch monitor, 72-Hz refresh rate

Software: DOS 5.0, Microsoft Windows 3.1

In short: The Poly 486SX-25Y is a well-built upgradable ISA system with a slightly better-than-average price. Polywell sent the test PC with a pushed-clock crystal designed to run the system at 26, not 25, MHz.

514 ON READER SERVICE CARD



Silicon Valley Computer

SVC-I486SX25-212

The combination of a fair $2,245 list price, good service and support, and better-than-average performance on four of our five benchmark tests puts Silicon Valley Computer's SVC-I486SX25-212 in a league with some of this issue's heavy players. It also shares some negative characteristics, such as the absence of a secondary cache or an upgrade socket so you can enhance the PC's performance down the road.

Our test unit came with 8MB of RAM, a Conner 212MB IDE hard disk, DOS 5.0, and Microsoft Windows 3.1. All five bays—three 5.25-inch half-heights and two 3.5-inch slimlines—are accessible. Silicon Valley uses its own motherboard and BIOS, plus an OPTi chip set; the CPU mounts in a standard socket. Even without a 487/OverDrive socket, the SVC 486BB "baby board" looks somewhat cramped because of its small size but still holds 32MB of RAM; a plug-in memory card adds 32MB more. Video, I/O, and caching disk controller cards fill three 16-bit ISA slots, leaving three others (and two 8-bit slots) free.

The SVC-I486SX25-212

Silicon Valley's computer hit high marks on our processor and memory tests, even though it has no secondary cache. Its disk score was above average as well, thanks to an UltraStor 15C caching disk controller with 2MB of RAM paired with a 16-millisecond 212MB Conner CP3204F hard disk. Its Graphics Winmark performance, also well above average, was due to a Portacom Technologies Eclipse II adapter that carried an S3 P86C911 accelerator, an AMI BIOS, and 1MB of video RAM. A 14-inch Datas monitor displays 1,024-by-768 resolution at 70 Hz.

▶ FACT FILE

SVC-I486SX25-212

Silicon Valley Computer, 441 N. Whisman Rd., #13, Mountain View, CA 94043; 415-967-1100; fax, 415-967-0770

List price (tested configuration): $2,245.

Memory and processor RAM cache: 8MB 70-ns SIMMs

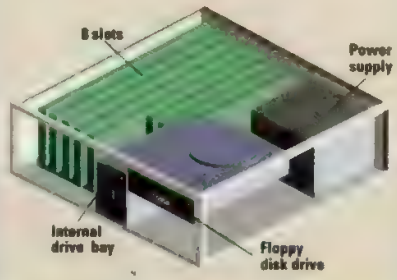
Disk drives and controller: Conner 16-ms 212MB IDE hard disk, UltraStor controller, 2MB cache, 1.2MB and 1.44MB floppy disk drives.

Display: Portacom Technologies 1,024-by-768 adapter with 1MB RAM, Datas 14-inch monitor, 70-Hz refresh rate.

Software: DOS 5.0, Microsoft Windows 3.1.

In short: With a competitive price and better-than-average performance on a majority of our benchmark tests, the SVC-I486SX25-212 is in a league with some of this issue's top contenders.

515 ON READER SERVICE CARD



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AutoCAD image courtesy of Autodesk, Inc.

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CIRCLE 047 ON READER SERVICE CARD

Silicon Valley sells direct and through dealers. A one-year parts-and-labor warranty attends the SVC. On-site service from Intel costs $190; an extended service contract costs 5 percent of the system price per year. Technical support is free, but you pay for the call.—*CNC*

Softworks Development Corp.

Citus MDC 486SX/25

Priced at $2,695, Softworks Development Corp.'s Citus MDC 486SX/25 comes with 4MB of RAM and a 128K secondary cache, but only a 130MB hard disk. Its performance is solidly average, but you can find similar units that cost less.

The small-footprint case holds five front-accessible drive bays and one internal. Softworks uses its own motherboard, adding an AMI BIOS, a UMC chip set, and a UMC cache controller.

Two 16-bit ISA slots hold the video card and IDE controller, leaving three other 16-bit and two 8-bit slots empty. The 486SX is mounted in a standard socket; the empty sockets nearby are for a Weitek coprocessor and a 386DX. There is no dedicated OverDrive socket. Everything is well laid out, except that the SIMM sockets are blocked by the hard disk and the IDE controller. The Citus MDC supports an array of processors; a 256K RAM cache costs $150.

The Citus MDC's 128K of direct-mapped, write-back cache produced an average processor score. Memory and disk scores were below average. The Western Digital video adapter, based on an unaccelerated chip set, produced an above-average video score but a typically low Graphics Winmark score. The 13-inch Delta CM 1448 monitor displays 1,024-by-768 resolution at 60 Hz.

Softworks distributes through dealers and VARs. The one-year warranty excludes physical damage and software reinstallation. On-site service from Monroe Systems costs $70 a year; toll-free support is available weekdays during business hours.—*BG*

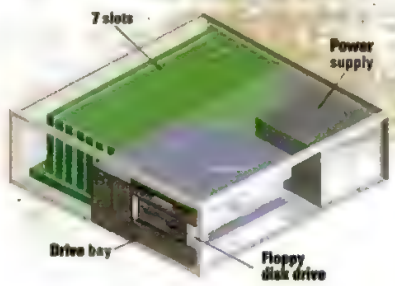
The Citus MDC 486SX/25

FACT FILE

Citus MDC 486SX/25

Softworks Development Corp., 10202 N. Enterprise Dr., Mequon, WI 53092; 800-332-3475, 414-242-8800; fax, 414-242-8825

List price (tested configuration): $2,695.
Memory and processor RAM cache: 4MB 60-ns SIMMs, 128K cache.
Disk drives and controller: Maxtor 15-ms 130MB IDE hard disk, 82K cache, 1.2MB and 1.44MB floppy disk drives.
Display: Premier 1,024-by-768 adapter with 1MB RAM, Delta 14-inch monitor, 60-Hz refresh rate.
Software: DOS 5.0.
In short: With so-so parts and average performance, the upgradable Citus MDC 486SX/25 is unspectacular.
916 ON READER SERVICE CARD



Spear Technology Inc.

Spear Super 486SX/25

Spear Technology's throw into the 486SX 25-MHz market falls short of the mark. At $2,985 for the Spear Super 486SX/25 EISA, you will find this EISA system erratically configured, alternating cutting-edge features with technological pitfalls. If an EISA system is what you need, seek something more stable.

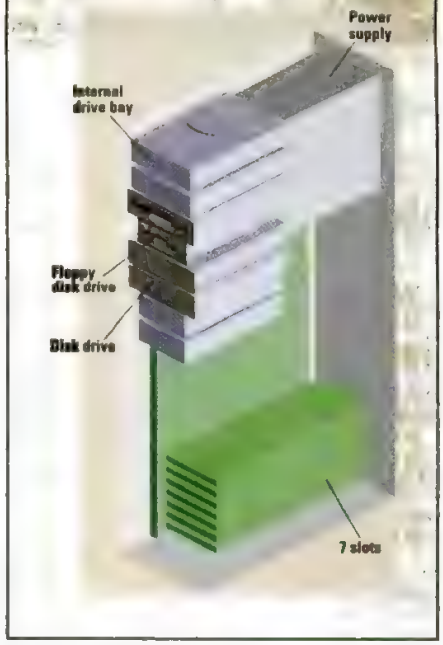
Housed in a standard tower case, the Spear contains eight drive bays. Its Elisa LM-486EISA motherboard has five standard EISA slots. Three proprietary slots are for the modular CPU card; one of the two local-bus slots holds the Spear's video implementation. Unfortunately, two of the five standard EISA slots are also taken by a careless I/O arrangement that wires the extra COM ports into the exit bracket of an empty slot. Internal cabling was a little messy, making it difficult to reach the SIMM banks, which can hold from 1MB to 128MB of system RAM. System memory, however, is backed by a processor RAM

FACT FILE

Spear Super 486SX/25

Spear Technology Inc., 425 Country Club Dr., Bensenville, IL 60106; 800-852-4202, 708-616-7800; fax, 708-616-7811

List price (tested configuration): $2,985.
Memory and processor RAM cache: 8MB 70-ns SIMMs, 256K cache.
Disk drives and controller: Maxtor 15-ms 213MB SCSI-2 hard disk, 32K buffer, BusTek controller, 1.2MB and 1.44MB floppy disk drives.
Display: 1,024-by-768 local-bus video with 1MB RAM integrated on motherboard, ViewSonic 14-inch monitor, 72-Hz refresh rate.
Software: DOS 5.0, Microsoft Windows 3.1.
In short: The EISA-based Spear Super 486SX/25 is too erratic a performer to be a good choice, especially with the stiff competition presented here.
917 ON READER SERVICE CARD



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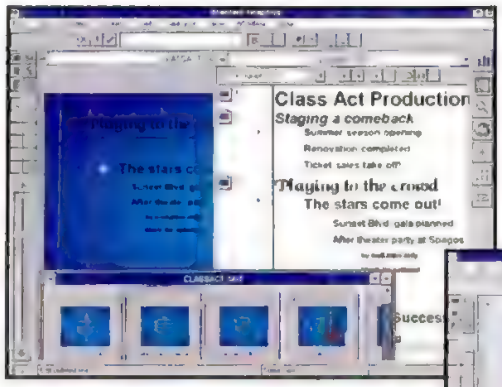

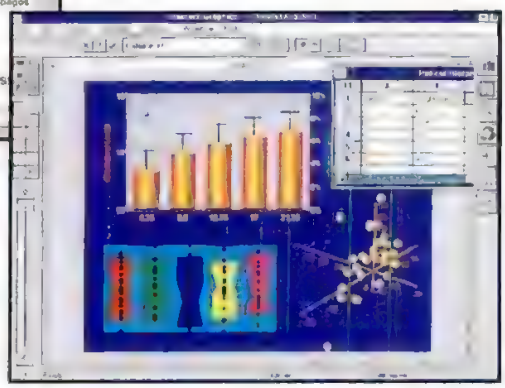

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CIRCLE 070 ON READER SERVICE CARD

The Spear Super 486SX/25

cache that can range from 64K to 512K; our test unit had 256K. The Maxtor LXT 2135Y 213MB SCSI-2 hard disk came with an uncached BusTek controller, while a Tseng ET4000 chip set was incorporated into a proprietary local-bus design. The display was a ViewSonic 5E.

Its processor and memory scores were both average, while the ET4000 local-bus video managed its usual fine performance on our DOS-based video test and a below-average Graphics Winmark score. The Maxtor hard disk, however, registered a far-below-average score compared with the rest of the hard disks in this review—most unfortunate if you consider the disk's SCSI and EISA advantages.

Sold only direct, the Spear comes with the usual one-year parts-and-labor warranty, first-year-free on-site service, and toll-free technical support.—*OR*

Swan Technologies Inc.

Swan 486SX/25DB

As an upgradable ISA-based design with local-bus video, Swan Technologies' Swan 486SX/25DB is a decent system with average performance. The $2,695 price is slightly above average.

The Swan's small-footprint case is good-looking on the outside and provides four drive bays: One carries a combination 3.5- and 5.25-inch floppy disk drive, while another holds the Maxtor 202MB IDE hard disk.

Swan's own motherboard uses an AMI BIOS and holds only six ISA slots, one of which is proprietary and occupied by the upgradable CPU and local-bus

The Swan 486SX/25DB

video card. System RAM can range from 4MB to 64MB on-board and is helped along by a 128K processor RAM cache. I/O and floppy/hard disk controller circuits are integrated, making for a clean and accessible interior. The upgradable processor card can provide a full array of 486 processors and also holds a Weitek coprocessor socket, but there is no OverDrive socket. Video is a proprietary local-bus design structured around an S3 86C911A chip set and 1MB of dedicated RAM. Swan's 13-inch monitor is a less-than-satisfactory display with 1,024-by-768 resolution possible only at 60 Hz.

Performance is where this unit's shortcomings stood out. Though the processor score was competitive, memory was below par, possibly due to the fact that the RAM cache was located on the CPU card, while system memory was on the system board. The Maxtor hard disk would have fared much better if it had a cache, while the video chip set, with its local-bus zing, managed to turn in respectable scores on our video and Graphics Winmark tests.

Swan sells direct and offers a two-year parts-and-labor warranty that includes on-site service from TRW at no extra cost. Technical support is via an 800 line.—*OR*

FACT FILE

Swan 486SX/25DB

Swan Technologies Inc., 3075 Research Dr., State College, PA 16801; 800-468-9044, 814-234-2236; fax, 814-237-4450

List price (tested configuration): $2,695.

Memory and processor RAM cache: 4MB 70-ns SIMMs, 128K cache.

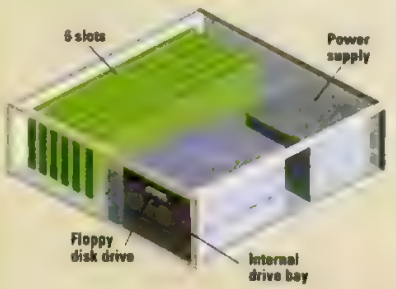
Disk drives and controller: Maxtor 16-ms 202MB IDE hard disk, 64K buffer, 1.2MB and 1.44MB combination floppy disk drive.

Display: 1,024-by-768 local-bus video with 1MB RAM, Swan 14-inch monitor, 60-Hz refresh rate.

Software: DOS 5.0, Microsoft Windows 3.1, Microsoft Works for Windows, Quicken for Windows, Wealth Builder

In short: This is a decent system, but given its average performance and feature set, the price could be a bit lower.

518 ON READER SERVICE CARD



Tandy Corp.

Tandy 4825 SX

The Tandy 4825 SX has an interesting swing-away chassis design that makes the highly integrated motherboard easily accessible to those doing swapping and upgrading. It came with 4MB of RAM, a 240MB hard disk, DOS 5.0, and Microsoft Windows 3.1. It also came with middle-of-the-road performance and a $3,058 list price tag, a few hundred dollars higher than the average.

The slimline case holds a motherboard that covers the entire bottom of the

The Tandy 4825 SX

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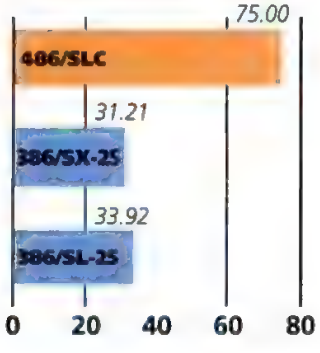

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case; the controller, RAM, I/O, and Western Digital video are all built onto it. With this degree of integration, the Tandy has only three 16-bit ISA expansion slots—fewer than other, less integrated machines have even after subtracting for the video and controller boards. RAM is expandable via SIMMs from 4MB to 32MB; cache RAM is not expandable beyond the 8K primary cache allotted. The Quantum hard disk takes one of the three available drive bays.

The Tandy showed average performance for a machine in this class. Its processor and memory scores were good. Perhaps because of the uncached disk controller, the 16-millisecond 240MB Quantum Gemini 240AT hard disk turned in a relatively low score. Its video score was above average, but only 512K of video RAM and an unaccelerated Western Digital chip set combined to yield a low Graphics Winmark score.

Other drawbacks include a keyboard buffer that is far too small for an experienced typist's use and a power switch placed dangerously close to the eject button for the 3.5-inch floppy disk drive. Though the sturdy keyboard was especially pleasant to use, the Tandy VGM-441 Super VGA monitor needs work: Its 56-Hz refresh rate caused noticeable eyestrain after continuous use.

Tandy Corp. offers a one-year parts-and-labor warranty and several extended service contract options. Depending on which of these the buyer chooses, service occurs either on-site or at a Radio Shack outlet. Technical support requires a toll call.—*AG*

FACT FILE

Tandy 4825 SX

Tandy Corp., 1800 One Tandy Center, Fort Worth, TX 76102; 817-390-3011

List price (tested configuration): $3,058

Memory and processor RAM cache: 4MB 80-ns SIMMs

Disk drives and controller: Quantum 16-ms 240MB IDE hard disk, Tandy controller, 1.2MB and 1.44MB floppy disk drives

Display: 1,024-by-768 video with 512K RAM integrated on motherboard, Tandy 14-inch monitor, 56-Hz refresh rate

Software: DOS 5.0, Microsoft Windows 3.1, Microsoft Works for Windows 2.0

In short: The Tandy 4825 SX has an interesting integrated design, but the list price is a bit high for its mediocre performance.

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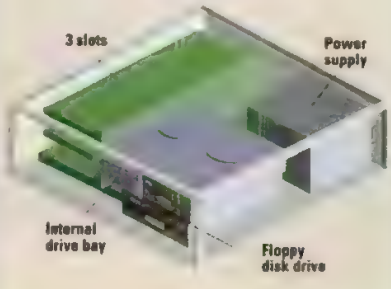

Tangent Computer Inc.

Tangent Model 425se

For the EISA-based $3,595 Tangent Model 425se, price as well as performance is above average; doubtless its 4MB Mylex caching disk controller accounts for some of both. But this PC's internal layout is not the best, and equivalent performance can be found in lower-priced machines.

The unit's NICE-EISA1 USA motherboard has a 486SX in a standard socket and a Weitek coprocessor socket, so OverDrive upgrades will mean pulling the CPU. Although its 4MB of RAM is expandable to 128MB on the motherboard, the last two SIMM banks are blocked by the power supply. A SIS cache controller handles the 64K direct-mapped, write-back cache.

One of the Tangent's six EISA slots is occupied by a Mylex EISA SCSI caching disk controller with 4MB of RAM (expandable to 8MB) that manages the 212MB Western Digital Piranha 4200 hard disk. Oddly, the slot lineup includes two ISA slots, occupied by the video and I/O cards, which could have been EISA slots since EISAs accept ISA cards. Video is based on a Diamond Stealth VRAM with an S3 accelerator and 1MB of video RAM; the card is paired with a 14-inch Sampo monitor that displays 1,024-by-768 resolution at 70 Hz.

The Tangent Model 425se

Four out of five bays (three 5.25-inch and one 3.5-inch) are accessible; the hard disk occupies the internal 3.5-inch bay. Unfortunately, the position of the hard disk makes it difficult to reach the upgradable CPU socket on the motherboard, and the Weitek coprocessor socket can't be reached at all.

Above-average performance on the Graphics Winmark test produced the Tangent's best score; processor and memory scores were on the high side of average. The disk score was very good too, but in order for the Western Digital

FACT FILE

Tangent Model 425se

Tangent Computer Inc., 197 Airport Blvd., Burlingame, CA 94010; 800-466-3300, 415-342-9388; fax, 415-342-9380

List price (tested configuration): $3,595.

Memory and processor RAM cache: 4MB 60-ns SIMMs, 256K cache.

Disk drives and controller: Western Digital 15-ms 212MB SCSI hard disk, Mylex controller, 8MB cache, 1.2MB and 1.44MB floppy disk drives

Display: Diamond 1,024-by-768 adapter with 1MB RAM, Sampo 14-inch monitor, 72-Hz refresh rate.

Software: DOS 5.0, Microsoft Windows 3.1

In short: Difficult to upgrade because of its tight design, the Tangent Model 425se does little to merit its high price tag

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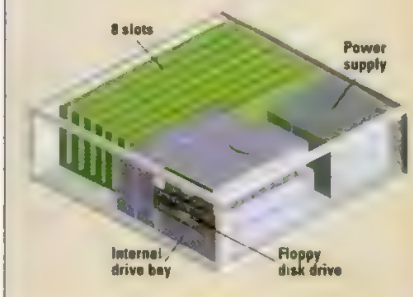


SCSI hard disk to work properly, disk controller drivers had to be used. Although Tangent Computer's documents state this, the information is neither strongly emphasized nor easily found in the documentation. Once the Mylex DCE376 driver was installed in the AUTOEXEC.BAT file, the disk worked properly and achieved a very decent score.

Tangent offers a one-year parts-and-labor warranty, on-site service from TRW, and toll-free technical support.—*TA*

Tri-Star Computer Corp.

Tri-Win 486SX/25

At $2,095, Tri-Star Computer Corp.'s Tri-Win 486SX/25 ranks among other low-end models. Good DOS-based video, plus decent processor and memory scores on our benchmark tests are the best it can offer. You could find systems that are better performers, have prices that are equal to or better than Tri-Star's, and also provide OverDrive socket upgradability.

The Contaq motherboard carries the system maximum of 32MB of RAM, a 486SX in a standard socket, a Contaq-based cache, and room for a Weitek coprocessor, but no OverDrive socket. To add or remove SIMM modules or expansion boards, you must navigate around wiring attached to the I/O hard disk pass-through board and the power supply. With the video and IDE boards, four of the six 16-bit ISA slots are free, as are two 8-bit slots. All five bays (three 5.25-inch and two 3.5-inch) are accessible. The

The Tri-Win 486SX/25

FACT FILE

Tri-Win 486SX/25

Tri-Star Computer Corp., 120 S. Weber Dr., Chandler, AZ 85226; 800-755-1000, 602-961-3401; fax, 602-961-4010

List price (tested configuration): $2,095

Memory and processor RAM cache: 4MB 70-ns SIMMs, 64K cache

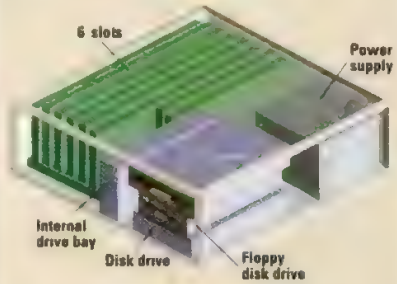
Disk drives and controller: Maxtor 15-ms 210MB IDE hard disk, DFI controller, 1.2MB and 1.44MB floppy disk drives

Display: Diamond 1,024-by-768 adapter with 1MB RAM, MAG 14-inch monitor, 72-Hz refresh rate

Software: DOS 5.0, Microsoft Windows 3.1

In short: The Tri-Win 486SX/25 is cheap, but by no means the cheapest system here. Performance is good, especially the memory subsystem, and there's some room to upgrade, but no OverDrive socket

521 ON READER SERVICE CARD



Tri-Win ships with a Diamond SpeedSTAR Super VGA graphics adapter and a 13-inch MAG monitor, which displays 1,024-by-768 resolution at an uncomfortably flickering 62 Hz.

The Tri-Win performed above average on our memory test but slipped a bit on the processor test, possibly because our processor test does not favor systems with small caches. The Tri-Win came with a 64K cache. The Diamond SpeedSTAR's Tseng ET4000AX chip set gave an above-average DOS video score but fared worse on Windows graphics, for which the unit was not designed. The Tri-Win's disk score was in line with those of other units without caching disk controllers.

Tri-Star offers a two-year warranty on parts and labor, but the company covers the monitor for only the first year. On-site service from TRW is free the first year, and technical support is toll-free.—*SGT*

Twinhead Corp.

Twinhead Superset 600/425C

A fully integrated motherboard and solidly average performance make the $1,989 Twinhead Superset 600/425C a competitive low-end machine.

The slimline unit came with 4MB of RAM (32MB maximum), a 64K cache, and a 213MB Conner hard disk. The Twinhead motherboard is fully integrated. Besides the IDE hard disk controller, video implementation, and ports, it has a 486SX in a standard socket and both coprocessor and OverDrive sockets.

The slimline design allows only four 16-bit ISA slots. Although all four were empty, horizontally mounted add-in cards would cover the SIMM slots, making memory upgrades difficult. Fortunately, the coprocessor and OverDrive sockets are easily accessible.

Three of the four drive bays are front-accessible and could easily fill up if you put in a CD-ROM drive or tape backup unit; an internal 3.5-inch bay holds the Conner hard disk. The 14-inch Relisys monitor displays 800-by-600 at 60 Hz; for $200 more, you can get an ADI Microscan 3E. But the uncached 213MB Conner hard disk is the largest Twinhead offers. With video integrated on the motherboard, there's no way to escape the pitfalls of the Trident chip set.

Although the processor score was solidly average, the memory score fell below, probably because a 64K secondary cache does not perform well on this test. The disk score was in line with that of other uncached disk controllers. The

The Twinhead Superset 600/425C

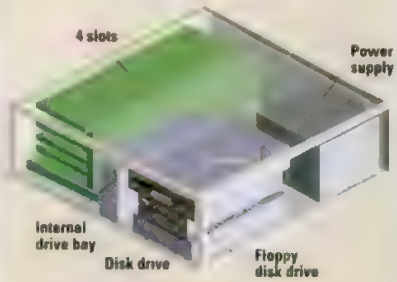
FACT FILE

Twinhead Superset 600/425C

Twinhead Corp., 1537 Centre Pointe Dr., Milpitas, CA 95035; 800-545-8946, 408-945-0808; fax, 408-945-1080

List price (tested configuration): $1,989
Memory and processor RAM cache: 4MB 80-ns SIMMs, 64K cache
Disk drives and controller: Conner 16-ms 213MB IDE hard disk, 1.2MB and 1.44MB floppy disk drives
Display: 1,024-by-768 video with 1MB RAM integrated on motherboard, Relisys 14-inch monitor, 60-Hz refresh rate
Software: DOS 5.0, Microsoft Windows 3.1
In short: The highly integrated Twinhead Superset 600/425C has a price low, but its performance is unspectacular

522 ON READER SERVICE CARD



video chip set, a Trident 8900C with 1MB of RAM, yielded a low score on both the DOS-based video and the Graphics Winmark tests.

On-site service is available free of charge from TRW on top of the standard one-year warranty on parts and labor. Technical support is toll-free.—*BG*

USA Flex Inc.

Flex 486SX/25 System

A good try from USA Flex to compete in the low-cost ISA market, the $1,929 Flex 486SX/25 System is held back by some below-average performance scores and some minor drawbacks in design.

The small-footprint case has five bays. Its Cache Computer motherboard holds seven ISA slots. A 1MB Diamond Stealth VRAM with an S3 accelerator fills one; all the rest is integrated. The motherboard holds the CPU, a 256K cache, and a Weitek socket, but no upgrade socket.

The Flex 486SX/25 System

Unfortunately the SIMM banks, holding 4MB to 32MB, are located behind four of the expansion slots, preventing the use of full-length cards. However, Slot 7 has a 32-bit extender for memory expansion. The hard disk is a 203MB IDE Western Digital Caviar and the monitor, a MAG ColorView 14C, is excellent.

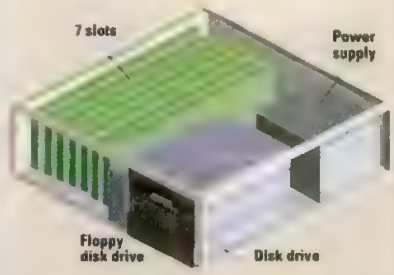
FACT FILE

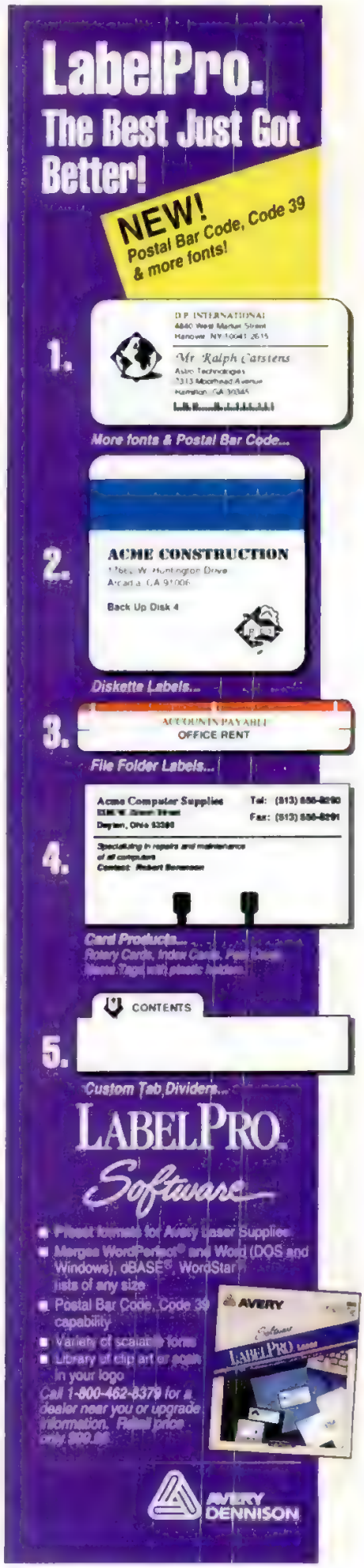
Flex 486SX/25 System

USA Flex Inc., 4711 Brighton Dr., Bloomingdale, IL 60108; 800-653-3539, 708-351-9700; fax, 708-351-7204

List price (tested configuration): $1,929
Memory and processor RAM cache: 4MB 70-ns SIMMs, 256K cache
Disk drives and controller: Western Digital 14-ms 203MB IDE hard disk, 64K buffer, 1.2MB and 1.44MB floppy disk drives
Display: Diamond 1,024-by-768 adapter with 1MB RAM, MAG 14-inch monitor, 72-Hz refresh rate
Software: DOS 5.0, Microsoft Windows 3.1
In short: The Flex 486SX/25 System is not a bad leap into the low-cost market. Unfortunately, its performance scores are below average, and the price, while cheap, still isn't the lowest

523 ON READER SERVICE CARD





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CIRCLE 235 ON READER SERVICE CARD

Though the processor score was good, memory and disk scores were below average. With DOS video slow because of the S3 chip, only the Graphics Winmark score was competitive.

If USA Flex were to improve this model more in performance and price, it would be worth a closer look. The standard warranty covers parts and labor for one year and includes on-site service from Dow Jones. Technical support, available on weekdays, is toll-free.—*OR*

U.S. Micro Express Inc.

Jet 486SX-25

Clever use of its chassis space makes U.S. Micro Express's $1,875 Jet 486SX-25 unique among the small footprints reviewed here. An optimal number of drives in a compact form gives you room for a broad mix of drive types. Just be aware that you're buying expansion, not performance, for this price.

The Soyo eight-slot motherboard is designed for SX and DX processors, including 33- and 50-MHz 486DX CPUs using standard sockets. Although this 16-bit ISA system lacks both math coprocessor and OverDrive sockets, it has a proprietary memory card slot to top off system RAM at 64MB. The video subsystem consists of an Orchid ProDesigner IIs and a 14-inch Supercom monitor with 800-by-600 resolution at 45 Hz. With video and IDE pass-through disk controller cards installed, four 16-bit and two 8-bit slots are left open. In addition, U.S. Micro Express manages to squeeze six usable drive bays into the system without compromising expansion slots. Three half-heights and two slimlines are accessible from the front; an internal 3.5-inch bay holds the hard disk.

Like other systems with a 64K cache, the Jet did not score well on our processor test; the memory score, however, was slightly above average. Disk performance from the 203MB Western Digital Caviar 2200 hard disk was in line with that of other systems with uncached disk controllers. The Orchid ProDesigner IIs video adapter, based on a Tseng ET4000AX chip set, scored well on the DOS-based video test but poorly on the Graphics Winmark test.

U.S. Micro Express's standard warranty for the system covers parts for one year and labor for two years. On-site service from Cascade Computer Maintenance costs $275 a year. An extended warranty costs $300 and offers two-year coverage on parts and four-year coverage on labor. As a handy reference, U.S. Micro Express silk screens its hotline number on the back of the system.—*GP* □

The Jet 486SX-25

FACT FILE

Jet 486SX-25

U.S. Micro Express Inc., 1930 116th Ave. NE, #204, Belleveue, WA 98004-3019; 800-874-5505 ext. 194, 206-462-7300; fax, 206-462-6303

List price (tested configuration): $1,875

Memory and processor RAM cache: 4MB 70-ns SIMMs, 64K cache.

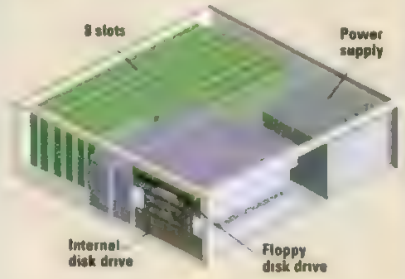
Disk drives and controller: Western Digital 14-ms 203MB IDE hard disk, DFI controller, 1.2MB and 1.44MB floppy disk drives

Display: Orchid 1,024-by-768 adapter with 1MB RAM, Supercom 14-inch monitor, 45-Hz refresh rate

Software: DOS 5.0, Microsoft Windows 3.1.

In short: The Jet 486SX-25 has a good price for average performance and features.

524 ON READER SERVICE CARD



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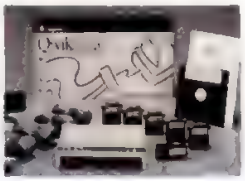

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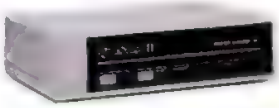

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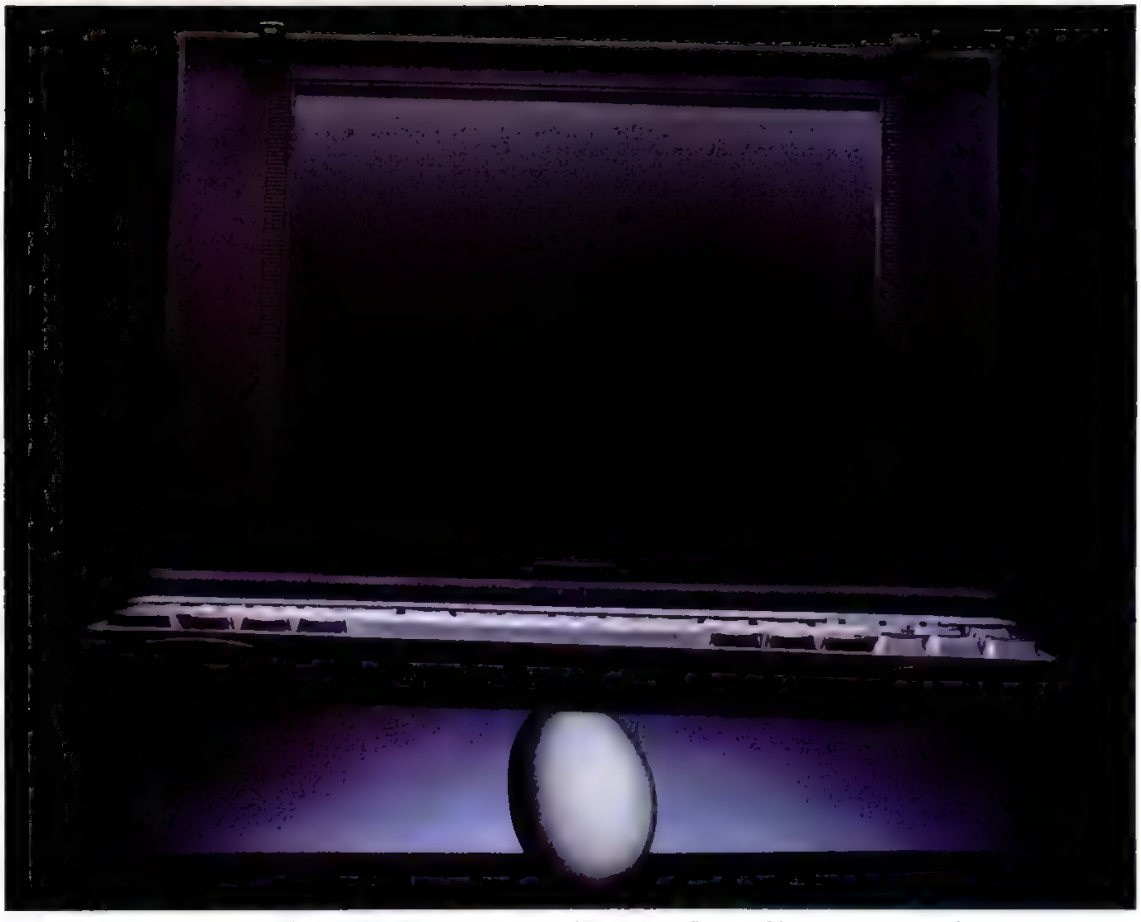

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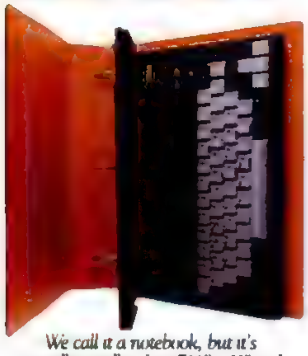

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CIRCLE 166 ON READER SERVICE CARD

DOS Lives!

Everybody's debating the relative merits of Windows versus OS/2, but most people are still using DOS. It's unobtrusive and undemanding, and it gets the job done.

by Jeff Prosise

When it comes to longevity, no other microcomputer operating system comes close. Since its introduction in 1981, DOS has beaten back the competition and grown in numbers to claim the title as the world's most widely used operating system. Despite its shortcomings, and despite the fact that much of it is based on 1970s-era technology, DOS is still going—and still growing—after more than a decade. And for better or worse, it's likely to dominate the personal computer operating system market for some time to come.

DOS is the driving force behind an estimated 100 million PCs worldwide. The numbers continue to mount, even though there are more powerful PC operating systems available. So what is it that keeps DOS users coming back? Speed is certainly one factor in DOS's favor; so are its modest hardware requirements, the huge installed base, and the wide variety of software available.

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Photograph by John Wilkes

As long as you don't load it down with TSRs, DOS provides an extremely stable operating platform. And it undoubtedly benefits from the inertia created by its position as the industry leader. But one factor that is often overlooked is that there are some things that DOS applications are just plain better at doing. Engineering firms, for example, prefer DOS-based CAD programs because of their speed and because CAD programs often use nonstandard input and output devices that are poorly supported in Microsoft Windows and IBM's OS/2.

In the pages that follow, we'll take a look at some of DOS's strengths and weaknesses. We'll explore the shape of DOS applications to come. We'll also examine a few of the software categories in which DOS enjoys a decided edge over competitive environments such as Windows and OS/2.

Is DOS dead? Quite the contrary. DOS lives, and Microsoft has big plans that should ensure DOS's continued success for some time to come. (For a glimpse at what the future holds, see the sidebar "It Ain't Dead Yet: The Future of DOS.") DOS has successfully fended off challenges from CP/M, UNIX, and OS/2, among others. If history is a reliable indicator of the future, a tough battle lies ahead for any would-be successor.

THE LIMITATIONS OF DOS

Without a doubt, the hot ticket for computing in the 1990s is the graphical user interface. GUI proponents argue that a visually oriented point-and-shoot interface makes computing at once faster and, because it requires less learning, more accessible to the masses. True enough. Unless you're comfortable typing commands such as BACKUP C:*.* A: /S to back up the files on drive C:, DOS, with its command line interface, can demand as much knowledge and expertise as any application program.

Is DOS dead? Quite the contrary. Microsoft has big plans for the future that should ensure DOS's continued success.

A more serious shortcoming is the 640K limit on memory available to DOS applications. In truth, DOS can use up to 1MB of RAM, but the architecture of the IBM PC limits it to 640K. Many workarounds exist—expanded memory, extended memory, DOS extenders, upper memory blocks created by 386 memory managers—but the fact remains that there is no seamless way for applications to access the megabytes of RAM that are present on today's typical 286, 386, or 486 machine.

The only sure way to break down these barriers once and for all is to run the processor in protected mode. But neither DOS nor its application programs are capable of running in protected mode, so the vast expanses of extended memory remain unreachable for most programs.

The bare-bones nature of DOS is a sticking point for software developers. Most mainstream application programs bypass DOS when they communicate with the screen, keyboard, or printer, because the services that DOS provides to interface with these and other devices are woefully inadequate. DOS offers no support, for example, for interrupt-driven

DOS Must Die!

by Charles Petzold

DOS is an innocuous little operating system that presents no obstacles to anything that applications wish to do. But it also provides very little support for applications. Most of DOS is devoted to the tasks of loading programs into memory and giving them access to files. DOS is single-tasking, 16-bit, unprotected, and limited to 640K of memory. The only user I/O facilities are based on a teletype metaphor or, if ANSI.SYS is loaded, a limited full-screen character-mode display.

Virtually no modern application can make due with this deficient platform. To go beyond the inadequate resources offered by DOS, applications must fend for themselves. We think of the non-Windows versions of WordPerfect, Lotus 1-2-3, and AutoCAD as DOS applications, but in the strictest sense they're not. They use DOS almost solely for file I/O and go directly to the hardware for everything else. The only true DOS-based word processor is EDLIN. Even the new DOS 5.0 editor, EDIT, directly accesses the video adapter hardware.

Application programs bypass DOS to get at hardware, and they use extensions to DOS for additional memory. From expanded memory to enhanced memory to extended memory, from EMS to XMS to VCPI to DPMI, programmers have had a variety of chaotic solutions for obtaining more memory in real mode. The only common characteristic is that DOS knows nothing about them.

One negative consequence of this ad hoc approach is a redundancy in programming effort; each programmer must reinvent the wheel. A more basic problem is that without a common programming interface for accessing hardware and memory (the natural province of the operating system), programs cannot work together properly. There are inevitable conflicts and incompatibilities that are obvious to anyone who has ever tried to run several TSRs or to multitask programs that use various types of DOS extenders.

DOS is not "protected." It may seem stable when all you're doing is running a single well-behaved application, but don't be fooled: DOS can be crashed with a one-statement BASIC or C program. There is nothing to prevent an application program from writing into the DOS memory area and violating the integrity of the operating system. In contrast, quite a bit of ingenuity is required to crash protected operating systems such as OS/2, Unix, or (coming soon to a beta site near you) Microsoft Windows NT.

serial port I/O. Developers spend valuable time writing drivers to support hundreds of different printers and video adapters. Hardware configurations are so diverse that it is difficult to write a program that runs on every PC, and beyond providing a common file system, DOS does little to help.

By contrast, an application that has been written for Windows will run without modification on any PC that meets Windows' hefty hardware requirements. More importantly, the responsibility for providing drivers is shifted from the software developer to the hardware manufacturer, so the developer is free to spend more time writing the core of the application.

Even learning to use several different DOS applications can be a chore. DOS does not provide a standard interface for its client application programs, so what works in one application probably won't work in another. To save a file in a Windows program, it's a safe bet that you can select Save from the File menu. In WordPerfect for DOS, by contrast, you press F10 to start the process. In Lotus 1-2-3, you press /FS. The list could go on and on. Research shows that the average PC user regularly uses two or three applications, while Macintosh users average about twice that. One possible explanation for the discrepancy is that the similarities between Macintosh software products enables users familiar with one application to move on to others more easily.

Another black mark against DOS is that it makes no provisions for multitasking. DOS was designed to run one program at a time, and attempting to do otherwise (except under very special circumstances) risks crashing the entire system. Even TSRs, which provide limited but welcome relief from the one-program-at-a-time rule, are no picnic when they conflict with each other or with other elements of the system. TSRs must go to extreme lengths to avoid violating DOS's non-reentrancy requirements (with certain exceptions, a TSR must not place a call to DOS if another call was in progress when the TSR assumed control of the system), and to this day many of the DOS functions that TSRs need to preserve system integrity have not been documented by Microsoft. Third-party products that add multitasking and task-switching capabilities to DOS-based systems abound, but none are as elegant—or as effective—as operating systems such as OS/2 that from inception were designed to run several programs at once.

STRENGTH IN SIMPLICITY

One of DOS's most obvious strong points is its modest hardware requirements. Windows requires a 386-based PC or better with at least 4MB of RAM to run at any kind of reasonable speed. DOS runs quite well with 640K, and on an 8088 if you prefer. Moreover, DOS applications are fast, in large part because most of them run in character mode. Even graphics-mode DOS applications tend to be several times faster than their Windows

Our Contributors: ROBIN RASKIN is an executive editor of *PC Magazine*. ANGELA GUNN is a staff editor of *PC Magazine*. EDWARD MENDELSON, CHARLES PETZOLD, JEFF PROSISE, SAL RICCIARDI, and CRAIG STINSON are contributing editors to *PC Magazine*. ROCK MILLER is a frequent contributor to *PC Magazine* and a former associate editor of the graphics team.

It's bad enough when a single program crashes. But in a multitasking environment, a system crash could bring down several other programs with it and destroy any unsaved data. Try running multiple programs at once via add-ons to DOS, and the operating system reveals an intolerable instability that results directly from its unprotected foundation. DOS-based multitasking solutions such as Windows and Quarterdeck's DESQview try their best to manage DOS programs, but they themselves have the fundamental flaw of running on top of DOS. Replace DOS at the bottom (with OS/2 or NT, for example) and you get a much more stable foundation, even for running DOS applications.

DOS programs are written as if they own the world, and they no longer do. Providing DOS compatibility in a fully protected multitasking operating system involves giving programs the impression that they're directly accessing hardware while not actually letting them do so. The operating system must run DOS programs in 386 virtual DOS machines that use virtual device drivers to intercept all hardware accesses. This is much less efficient than offering programs a common API (application programming interface), and it just doesn't work very well.

Just about every computer user these days wants task switching and multitasking and the ability to use multiple megabytes of memory. DOS inhibits the future progress of this industry by forcing programmers to directly access hardware and build 32-bit protected mode into their applications, when such tasks should be the responsibility of the operating system. Programmers and users are ready for the future; DOS is not.

If we continue to pretend that DOS is an adequate platform for the 1990s, DOS will continue to survive. We must make a deliberate effort to overcome the inertia, rid our desktops of DOS, and replace it with something better. DOS must die. □

counterparts, because they are unburdened by the GDI (Graphics Device Interface, the component of Windows that programs use for screen output), opting instead to write directly to the display hardware.

What one person construes as a weakness, another sees as a strength. To the user who is familiar with DOS commands and is an adequate typist, the command line is a weapon, not a trap. And the whole issue of consistent user interfaces is painted in shades of gray, not black and white. Some users don't like the Windows interface and prefer the individuality that DOS encourages among applications. Once your fingers are trained to press F10-Enter-Y to save a WordPerfect document, the action becomes reflexive. And it's just as fast, if not faster, than selecting the Save option from a pull-down menu.

The very simplicity of DOS makes some things possible that are not feasible under more complex operating environments. For example, you can create some very powerful DOS utilities with DEBUG. The DOS API (application programming interface) is simple enough that even novice programmers can learn to write useful add-ons. By contrast, the Windows API is very complex and requires months to master. Moreover, writing software for the Windows environment requires sophisticated software tools such as resource editors, compilers, and Windows-hosted debuggers. It's no coincidence that there is less shareware and freeware available for Windows. The large investment in time and money that Windows programming demands means there are far fewer basement hackers equipped to tackle the job.

Another point in favor of DOS is its extensibility. You don't like the command line interface? Use PCED from Coft Software or DOS 5.0's DOSKEY to make the command line more user

▪It Ain't Dead Yet: *The Future of DOS*

by Jeff Prosise

By the time you read this, MS-DOS 6.0 should be well beyond the planning stages and in beta testing at thousands of sites around the world. Here's what you might see in the successor to Version 5.0, and a glimpse at what may lie beyond Version 6.0.

First, expect to see Microsoft do something to make the process of utilizing upper memory on 386- and 486-based systems easier. In Version 5.0, setting up your CONFIG.SYS and AUTOEXEC.BAT files to load programs and device drivers high is not unlike tuning a carburetor: If you tweak it just right, you'll get wondrous results, but you had better know what you're doing before you start. DOS 6.0 will include memory optimization capabilities that will take the guesswork out of loading high, not unlike the capabilities featured in third-party products such as QEMM-386 and 386MAX. Look for EMM386 to be enhanced, too, with more flexible expanded and extended memory support.

Second, don't be surprised if DOS 6.0 offers on-the-fly disk compression. The huge success of third-party compression utilities (such as Stac Electronics' Stacker) is proof that no amount of hard disk space is enough. In addition, there's something to be said for making on-the-fly compression part of the operating system rather than an add-on. To further enhance disk operations, Version 6.0 will ship with an enhanced version of SMARTDrive whose performance will meet or exceed that of SMARTDrive 4.0 (shipped with Microsoft Windows 3.1) and that will cache data from floppy disks as well as hard disks.

Third, DOS 6.0 will boast several new operating system utilities, including a new hard disk backup program, a hard disk defragmenter, an antivirus package, and an improved Undelete utility.

Other enhancements should include expanded command sets for CONFIG.SYS and AUTOEXEC .BAT, a means for choosing between different configurations at startup, and tighter integration between DOS and Windows. DOS 6.0 will also feature a surprise or two for network users—especially those running Windows for Workgroups. And like Version 5.0, DOS 6.0 will be available in ROM, featuring Advanced Power Management (APM) to lengthen battery life on laptops and notebooks and an Interlink utility for transferring files via null-modem cable. DOS 6.0 has yet to be officially announced, but Microsoft expects to ship it sometime in the first half of 1993.

What will DOS look like beyond Version 6.0? One can only speculate, but DOS may someday become a DPMI (DOS protected-mode interface) server that enables specially written applications to access more than 1MB of RAM on 386 machines and better, while retaining compatibility with apps written for previous versions. A version of DOS written to take advantage of the 386 architecture could also improve performance by using the fast 386 instructions, and by implementing hardware-based multitasking and task switching by running programs in separate virtual machines.

Another logical move would be to add faster file systems to DOS to supplement the aging FAT (file allocation table) system. Rather than replace the FAT, the new file systems will probably be user-installable like OS/2's HPFS (High Performance File System). As part of its Portable Computing Initiative, Microsoft is working on a flash file system that uses flash memory—not disks—for data storage.

Of course, there's always room for more and better utilities, additional networking support, and a closer tie to Windows. DR DOS fans will be interested to know that the popular MS-DOS replacement is being incorporated into Novell's NetWare. But make no mistake about it: Digital Research is not the only company working on improvements. Microsoft's commitment to DOS appears genuine, and the future looks bright indeed. It's a safe bet that DOS will become more powerful, more stable, and easier-to-use, and it's us—the end users—who will benefit. □

friendly, or use XTree to hide it altogether. If multitasking is a must, then check out DESQview. If memory runs short, memory managers such as QEMM-386 and 386MAX can work wonders on a 386 or 486.

DOS: POWER PLATFORM FOR THE FUTURE?

As many observers have pointed out, people don't buy operating systems. They buy PCs to run application programs, and once the applications are chosen, the choice of an operating system becomes a natural consequence of that decision. The simple fact of the matter is that DOS is plenty good enough for the vast majority of users. You don't need a Mercedes to drive to the grocery store once a week when a Honda will do. By the same token, you don't need Word for Windows to write an occasional memo when WordPerfect does quite nicely.

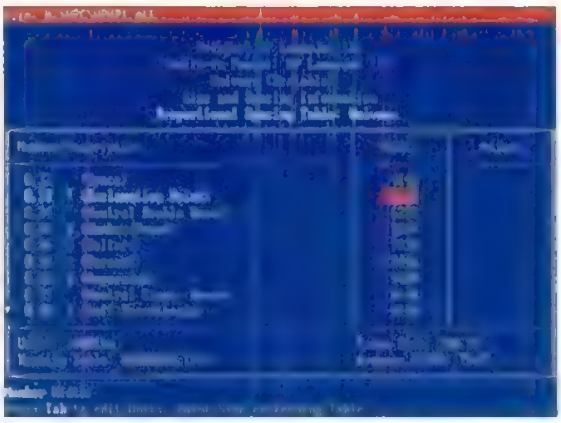
To this end, *PC Magazine* has assembled a team of experts to examine the major DOS application categories and tell you what's right—and what needs fixing—in each area. The categories include word processors, spreadsheets, graphics and animation packages, database managers, communications packages, task switchers, and applications development tools. In addition, you'll get previews of what's coming from the major application vendors; none of them has abandoned DOS.

Don't throw out that old 8088 just yet. Paired with the right software, it might be all you need for several years. To be sure, the extra speed of a 386 or 486 is always a welcome boost, even if all you do is run DOS applications. But that's the beauty of it: No matter what kind of hardware you have, DOS is as ready, willing, and able a partner as it was ten years ago. And with the enhancements Microsoft has planned for the future, DOS could easily be your partner for the next ten years. □

Text-Mode Word Processing

BY EDWARD MENDELSON

Graphics applications thrive best in a graphical user interface environment, but applications that manage text still perform at their best in the austere environment of DOS. Without the burden of a GUI display, character-based word processors let you work at the fastest clip possible. They also let you get your work done with the fewest distractions possible: There's never a game of solitaire hidden temptingly behind an application window, and you can't experiment with zoom levels when you work in a screen with 80 characters on each of its 25 lines.



WordPerfect's printer definition program gives you control over the printer far beyond anything available in Windows or OS/2. This screen lets you modify mapping and character widths for all fonts. Other screens let you define kerning.

Even if you use a text-based word processor, you'll probably long for the convenience of a more visual environment when you adjust page layout or manipulate fonts. The latest generation of DOS word processors lets you switch between text mode and a fully editable visual mode, depending on whether your priority at the time is speed or convenience. In contrast, no GUI word processor lets you switch into character mode (though most offer a draft mode that still operates in a graphical interface). You won't find comparable flexibility under any operating system but DOS.

Until recently, all DOS word process-

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ors used graphics only for an uneditable print preview. You had to make format adjustments in text mode, switch to the preview to see the results, then switch back to text mode for further adjustments. That changed last year when Xyquest introduced Signature. In a single keystroke the word processor switches between text mode and a WYSIWYG editing mode which displays the same Bitstream Speedo fonts that the program uses for printing.

WORDPERFECT'S EDITABLE WYSIWYG

Signature 1.0's visual mode is too limited and awkward for serious use, though. In contrast, WordPerfect 6.0 (due out later this year) will let you switch between its familiar text mode to a sleek and advanced visual mode.

Both text and visual modes will let users of earlier versions work without retraining, but the program will add a new menu-driven interface—refined by extensive usability testing—which is often more intuitive than Windows. For example, unlike Windows, WordPerfect won't abruptly close a dialog box if you press Enter instead of Tab. It will let you back out of dialog boxes step by step, instead of lurching back to the top-level menu. Alone among major vendors, WordPerfect Corp. plans to keep its DOS version as advanced as its Windows version.

WordPerfect Corp. is keeping pretty quiet concerning its new version, but it's easy to draw some conclusions about what we can expect by looking at the overhauled interface of DrawPerfect, WordPerfect's companion graphics package. WordPerfect 6.0 for DOS will almost certainly use both Type 1 and Speedo fonts for the screen, and these along with virtually any other font format for the printer. (WordPerfect Corp. recently licensed Adobe Type Manager for use in most of its new products.) The DOS version will incorporate the button bar and other conveniences already built into WordPerfect 5.1 for Windows, and will be fully compatible with files created by earlier versions.

The new DOS version will also incorporate voice annotation and MIDI support so you can create multimedia documents of the kind normally available only in Windows. You'll also be able to fax documents directly from the print menu and use an advanced BASIC-like macro programming language—standard in Windows word processors but unknown in DOS packages. WordPerfect will also finally incorporate some major features that it had lacked but that you could find in Microsoft Word for DOS. These features include workable style sheets, the ability to apply formatting directly to selected text without inserting codes, collapsible outlining, nine scalable document windows, and a "ribbon" for quick access to formatting controls.

After the new DOS version hits the streets, the next version of WordPerfect for Windows will follow. But for many users, the visual amenities of WordPerfect for DOS will be all they need.

MEANWHILE, BACK AT MICROSOFT

Microsoft hasn't forgotten Word for DOS, although the next version of Word reportedly won't be as major an upgrade

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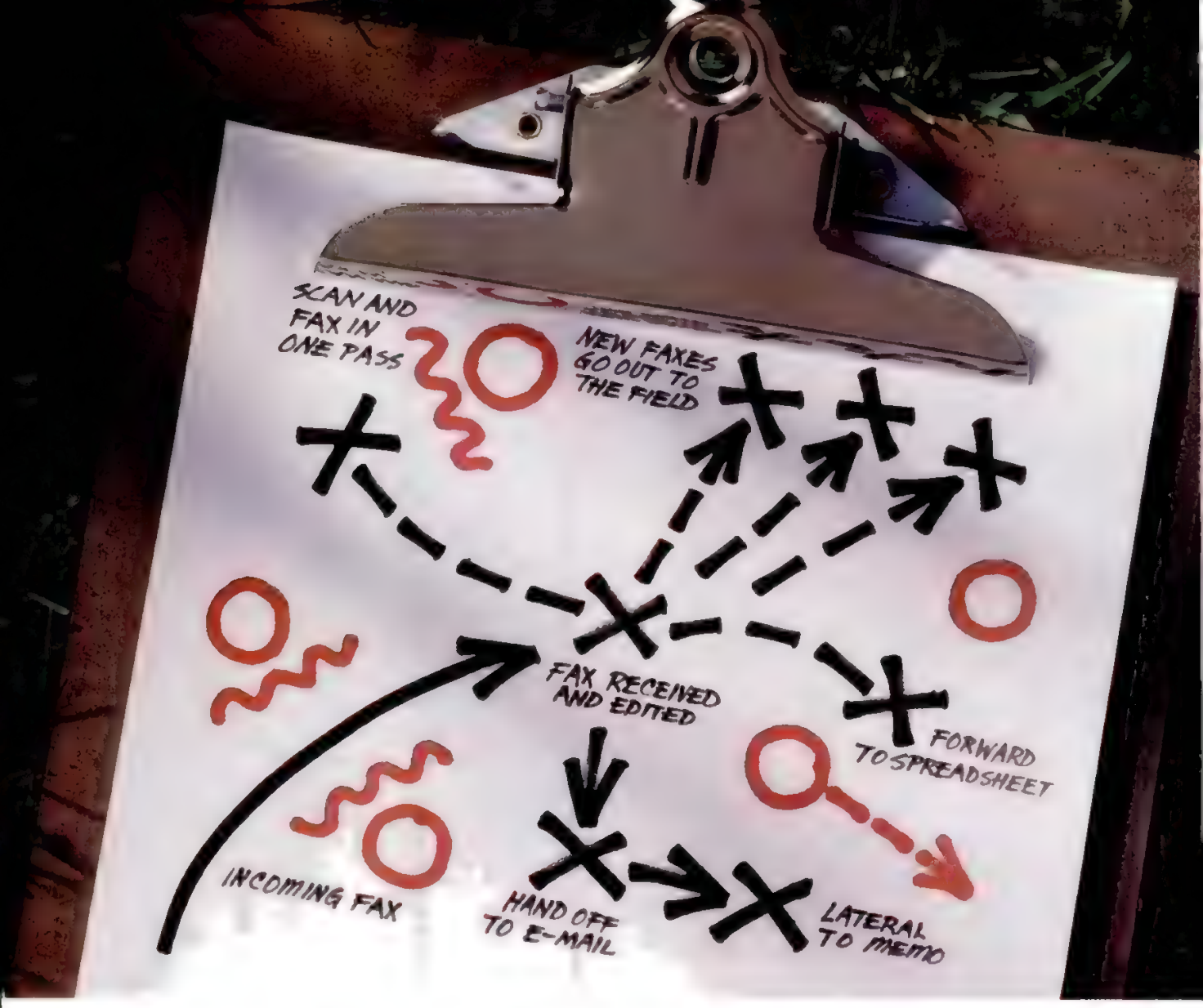

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CIRCLE 363 ON READER SERVICE CARD

as the next WordPerfect. No one at Microsoft will even admit that a new version is in process, but reliable sources report that Word 6.0 will support TrueType fonts for its noneditable preview mode and for the printer. Word for DOS will apparently also gain some of the major features of Word for Windows, including drag-and-drop editing, tables, and the hand-holding print-merge helper that lets you produce form letters without pain. Word for DOS will remain the only word processor that includes character styles in its style sheets in addition to the usual paragraph styles.

Nota Bene, from N.B. Informatics, remains the only high-end word processor that continues to ignore visual-mode amenities entirely and concentrate all its energy on manipulating text. Version 4.0 of the program retains and improves Nota Bene's academic and foreign-language support, but you will find it superior to rival programs even if you never use its academic features. Built on an improved version of the XyWrite engine, Nota Bene remains the fastest and most flexible program for ordinary text entry and editing, with built-in one-key shortcuts for deleting or transposing words, sentences, and paragraphs.

If you want a fully integrated environment for managing text, you can only get it from Nota Bene. An optional add-in lets you pop up a text database for instant access to any data in any document. Another option gives you the fastest and most powerful bibliography and footnote management of any program on the market. These work together far more seamlessly and quickly than any combination of Windows applications linked by Windows' Dynamic Data Exchange and Object Linking and Embedding.

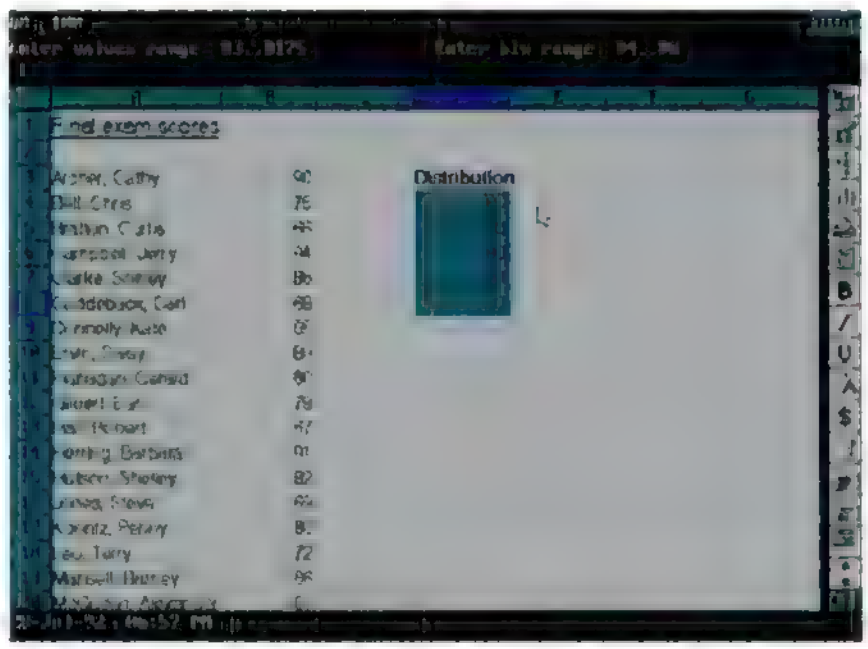
Nota Bene doesn't need Windows to support non-Roman alphabets. Another optional add-in supplies printer and screen fonts for Greek, Hebrew, and Cyrillic text, and all these alphabets can be indexed and searched in the text database.

In *PC Magazine*'s recent survey of DOS word processors, WordPerfect was awarded Editors' Choice, and Word for DOS and Nota Bene received honorable mentions. The newest versions of all three give word processor users plenty of reasons to stay loyal to DOS. □

Speedy Spreadsheets

BY CRAIG STINSON

There has been much intriguing innovation in spreadsheets designed to run under Microsoft Windows. For example, with Microsoft Excel for Windows, you need only highlight the relevant numbers and click on the Graph icon to embed a visual display right next to your table. Windows spreadsheets can also take advantage of DDE (Dynamic Data Exchange) and OLE (Object Linking and Embedding), which greatly increases the number of data sources a spreadsheet can access and import from. But DOS still has fundamental advantages over Windows as an operating environment for spreadsheets.



Lotus 1-2-3's tight machine code gives it a significant performance edge in certain tasks, such as calculating the frequency distribution of this set of exam scores. Icons provide an alternative to the familiar slash-command hierarchy.

For one thing, character mode is just plain faster. When recalculating spreadsheet formulas, there's no reason that a DOS program must be faster than a Windows program. And, in fact, on *PC Magazine*'s general-purpose number-crunching benchmark tests, Excel for Windows and the DOS packages Lotus 1-2-3 and Borland's Quattro Pro have turned in remarkably similar performance profiles. But character-mode programs will always manipulate the screen faster, and screen performance has an undeniable impact on a program's usability. Moreover, because 1-2-3, Release 2.*x*, is still built largely on the assembly language code base of the original 1-2-3 (which was designed to run on an 8088-based PC with 256K of RAM), it offers superior speed in many areas that don't involve routine arithmetic calculations. Generating a frequency-distribution table, for example, is a lot quicker in 1-2-3 than in Excel.

DOS spreadsheets use less memory. Byte for byte, you get a lot more basic functionality from a DOS spreadsheet than from a Windows version. Quattro Pro 4.0 and 1-2-3, Release 2.4 (the current installments of the market's dominant players), let you do serious analytical work and stunning presentations on systems with no more than 640K of RAM. Quattro Pro's virtual-memory technology (the program swaps code segments in and out of memory as needed) allows users to get started with only 512K.

With either 1-2-3 or Quattro Pro, you'll need expanded memory if you want to create large monolithic worksheets. But you don't have to take this approach; with careful planning, you can build large structures by linking files that are small enough to fit in conventional memory.

THE ADVANTAGES OF INCUMBENCY

The DOS versions of 1-2-3 have an unparalleled aftermarket. Like interstellar dust, aftermarket energies are drawn to the strongest local gravitational field. 1-2-3's decade-long preeminence has allowed it to attract a wealth of add-in products that may never be matched by any Windows program. Add-ins let users of 1-2-3, Release 2.*x*, tailor their spreadsheets to perform specialized tasks without significantly adding to the program's memory burden or dramatically increasing its cost.

Users who want spreadsheet outlining, for example, can pick up a copy of Symantec's The Budget Express. (Excel users get outlining whether they want it or not.) Other add-in vendors, such as Personics and Intex Solutions, have products that perform advanced financial cal-

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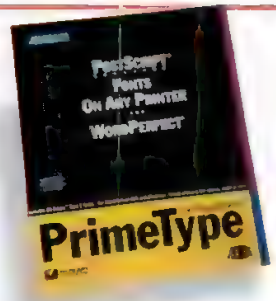

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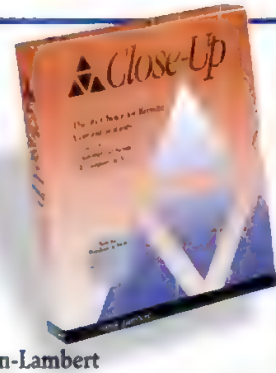

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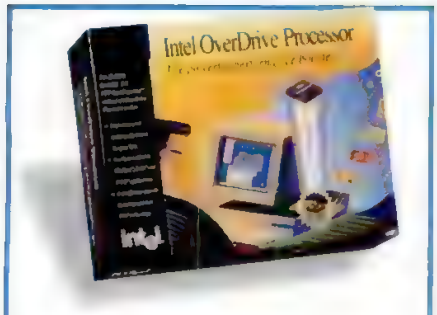

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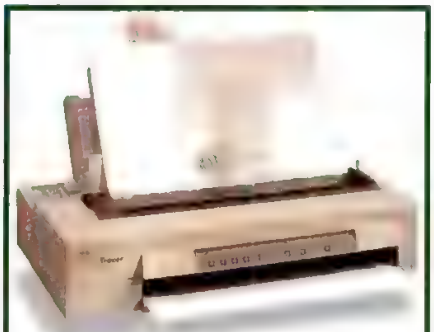

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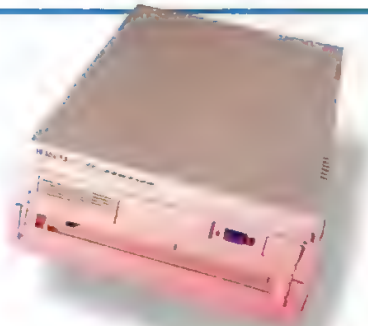

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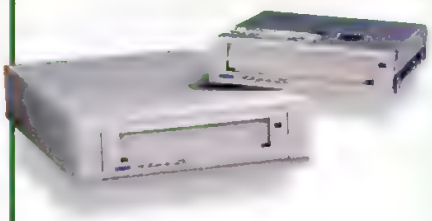

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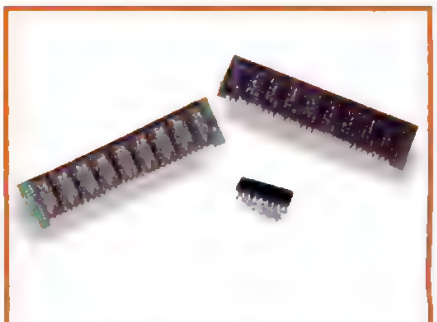

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culations. Intex, for example, sells a bond-analysis package that handles not only garden-variety U.S. bonds but also Canadian T-bills, Australian corporate bonds, British Eurosterling bonds, Japanese Samurai, stepped payment-in-kind (PIK) bonds, and a good deal more.

DOS should remain entrenched, too, because of its huge installed base: Billions of lines of 1-2-3 and Quattro Pro macro code beg to remain in their homeland. Transporting worksheets to the promised land of Windows is burdensome enough if the worksheets contain nothing but numbers, labels, formulas, formatting information, and printer setup strings. When macros are involved, the price of emigration may well be prohibitive.

It's not impossible to move 1-2-3 and Quattro Pro utilities to Windows. Excel now includes an interpreter that runs native 1-2-3 macro code and even allows you to enhance a 1-2-3 application with an admixture of Excel code. The macro languages in both 1-2-3 for Windows and Quattro Pro for Windows are easy-to-understand extensions of their DOS forerunners. Nevertheless, issues remain. Macros that depend on fixed screen dimensions have suddenly to cope with movable, sizable windows. Macros that skip out to DOS for housekeeping chores may find the trapdoor sealed. It's a discouraging prospect to take something that works and drop it into an environment full of unknowns.

It ain't broke. Which brings us to the final and most compelling argument in favor of DOS. For the vast majority of spreadsheet tasks performed by the vast majority of spreadsheet users, the DOS programs not only work just fine, they work spectacularly well. If you have the Lotus menu tree burned into your motor neurons, if the templates and macros you've developed over the years accomplish their missions, if you don't awake at 3 A.M. with a burning desire to link and embed, is there any reason to feel dissatisfied with your lot? None at all. But you might want to peer across the fence from time to time; some interesting things are happening over there. □

Graphics and Animation

BY ROCK MILLER

Microsoft Windows may be just catching on in most areas, but graphics is its stronghold. Most graphics software categories are dominated by Windows packages, and although DOS perennial Harvard Graphics (from Software Publishing Corp.) still outsells Windows business graphics packages, applications developers are concentrating most of their design attention on the Windows side. It would definitely be a mistake to imagine, however, that DOS is simply holding on by force of inertia; DOS programs are still strong contenders in some graphics areas.

Windows' interface consistency, protected-mode memory handling, and interoperability recommend it for all types of software, but what really gives it a decisive advantage in graphics packages are its technical characteristics. The consistent and comprehensive imaging model represented by Windows' GDI (Graphics Device Interface) takes care of a lot of what would otherwise be very arduous graphics programming, from generating drawing primitives to handling 24-bit color. Windows offers standard graphics and sound file formats, and the ubiquity of font managers (such as Adobe Type Manager) and the advent of TrueType in Windows 3.1 eliminates the need for programmers to create their own font-handling routines. All this adds up to richer, more robust programs, because software developers have been freed from the drudgery of coding the basics.

Windows is the king of graphics, but performance-intensive graphic tasks such as CAD do better under DOS. Like many professional CAD packages, AutoCAD, Release 12, benefits from 32-bit processing and optimized graphic routines.

Another important advantage of Windows is its device independence. Unlike developers who create graphics programs under DOS, Windows developers don't have to worry about writing, debugging, and supporting device drivers for the huge range of graphics cards, printers, and input devices on the PC market; that job is taken care of either by Microsoft or by the hardware vendors. And Windows users can be certain that, no matter how odd or specialized their hardware, it's likely to be supported by the graphics package they choose. Since graphics users form a large part of the market for sophisticated hardware such as high-end color printers, this gives a powerful sales advantage to Windows programs.

PAYING IN PERFORMANCE

Unfortunately, what Windows gives in flexibility and device support it takes away in performance. Its native deficiencies can be worsened by poor drivers, over which the application developer has no control. On the other hand, DOS erects few barriers to developers willing to take the trouble to code custom graphics routines that address hardware directly. With DOS extenders it's possible to write 32-bit programs that take full advantage of the powerful protected modes of the 386 and 486 processors while remaining DOS-compatible. Windows, however, in its essential graphics operations remains firmly in the 16-bit world.

In areas where performance is crucial, then, DOS programs have an opportunity to shine. This dynamic is most visible in the CAD market, where the exacting requirements of interactive editing of complex drawings puts a premium on speedy graphics. Although Windows-based CAD packages are available (Drafix Windows

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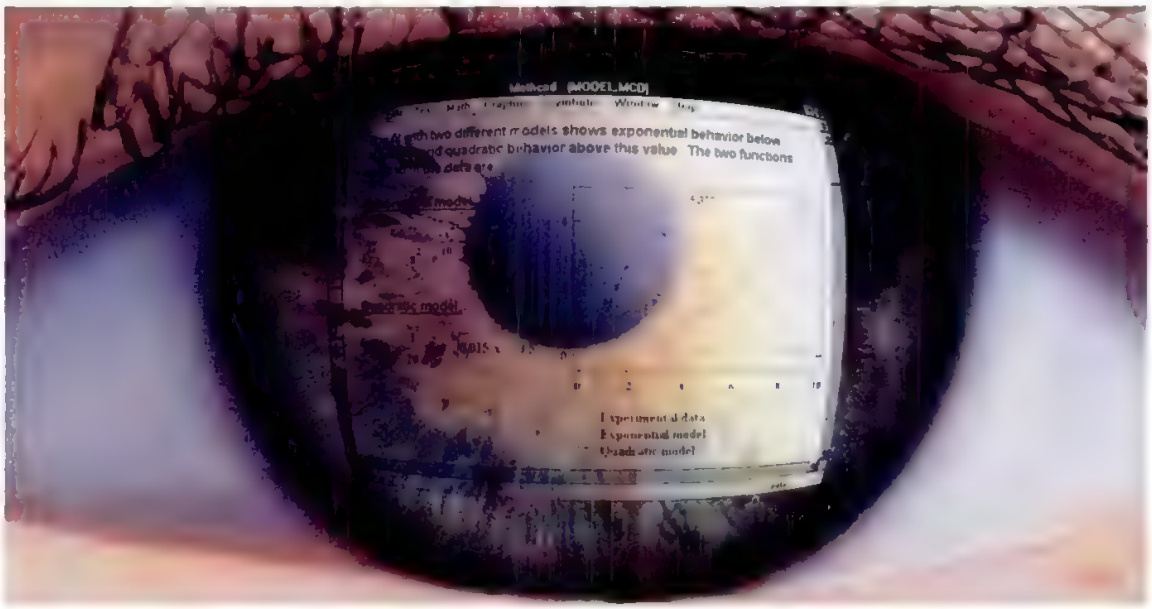

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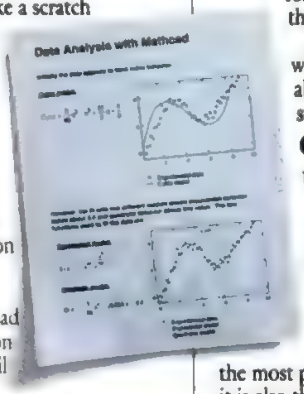

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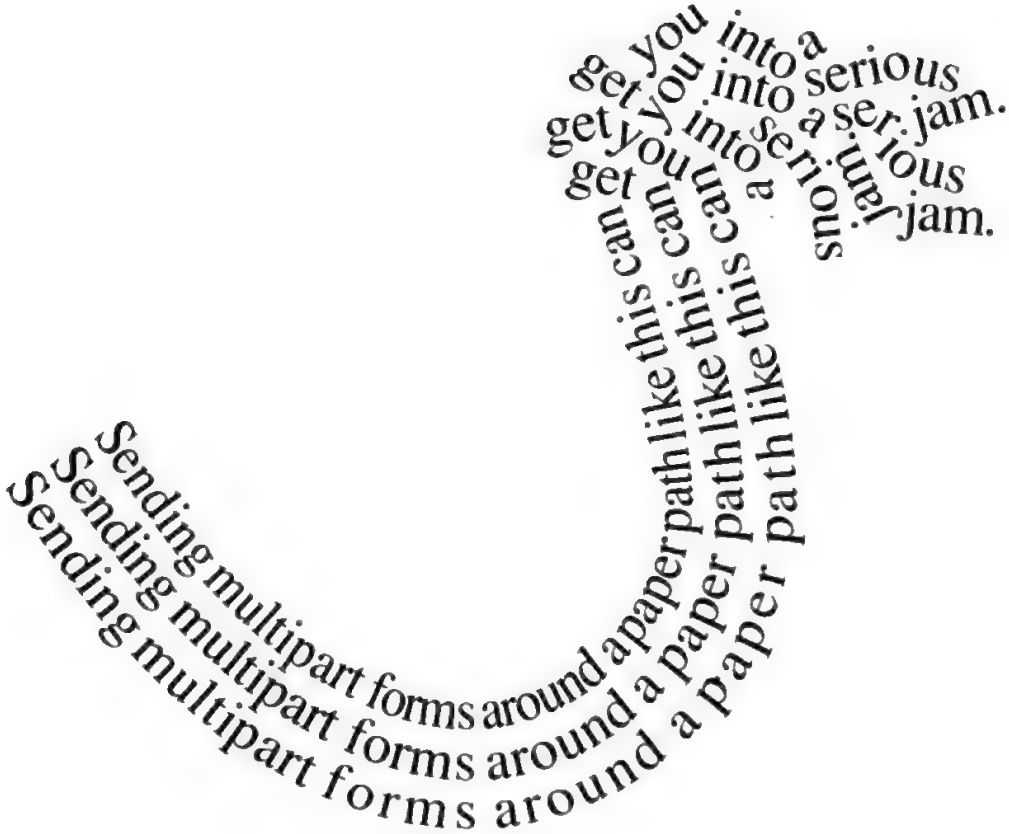

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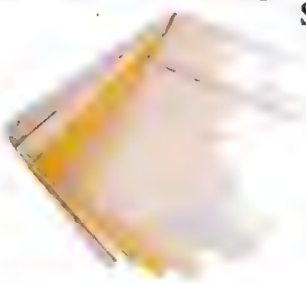

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FLAT-OUT-RELIABLE IBM PPS II

CAD has been available for some years from Foresight Resources and Autodesk recently released a Windows version of its best-selling product, AutoCAD), the vast majority of CAD programs are written to run under (or around) DOS. AutoCAD shows why this is so: In our performance tests, we found screen redraws to be about four times as fast under the protected-mode DOS version of AutoCAD, Release 11, as under the Windows version.

Performance also makes the critical difference in the growing area of animation and multimedia. Real-time image rendering is even more demanding than redrawing large technical images, and speed must be maximized if jerky motions are to be avoided. The addition of live video adds an extra twist: It requires conversion of NTSC- or PAL-standard video into a form that can be displayed on a computer monitor. The Windows GDI doesn't support this internally, and although Windows drivers can certainly be rigged to display NTSC video (as is done by Hauppauge Computer Works' Win/TV), this requires custom programming, the same as under DOS.

THE PLUSES OF PARSIMONY

There's a good reason for the persistence of DOS in the business graphics market, as well. Harvard Graphics, for instance, is still the leading graphics product, and not just for historical reasons. Without the heavy overhead of Windows, it remains compact enough to run well on the large installed base of less-powerful machines, as well as on laptops (the fastest growing segment of the PC market), which usually have limited power and minimal graphics abilities. The latest DOS version of Harvard Graphics incorporates a mouse-driven drawing canvas for WYSIWYG editing and uses Bitstream's Speedo technology for scalable fonts, but retains the text-mode, fill-in-the-form approach that has made it so popular for quick-and-dirty charting from worksheet data.

Borland's well-designed VROOM virtual memory system does a good job of limiting the adverse effects of DOS's 640K ceiling.

Borland's Quattro Pro, whose graphics abilities extend far into the business presentation arena, also makes a good case for the viability of DOS as a graphics platform. Its well-designed VROOM virtual memory system does a good job of limiting the adverse effects of DOS's 640K ceiling, while its ability to run in either character or graphics mode lets you be as parsimonious as you want with resources. This kind of technical flair is still valuable—even when RAM chips seem as cheap as popcorn and yesterday's dream machine becomes today's barely adequate baseline. □

Good, Bad, or Just Indispensable?

by Robin Raskin

Winston Churchill once said, "Democracy is the worst form of government except all those other forms that have been tried from time to time." That's sort of how sentiments ran concerning DOS as an operating system as we planned for this story. Our e-mail message boards overflowed as *PC Magazine* contributing editors and others rushed to offer their opinions—and everyone had a definite opinion.

The most common sentiment? "DOS is the thing we love to hate." All of us can see its limitations, we just haven't found anything to take its place. DOS is where we quit playing with new applications and settle down to get some real work done. Bruce Brown called Lotus Express the "iron lung" of his life. For a large and vocal majority, the same definition fits Norton Commander from Symantec and TAPCIS. These applications keep us alive, even if they tend to be less than elegant. Jim Seymour targeted Lotus Magellan's indexing, GOfers's ad hoc searching, and Hotline 2's unique functionality as good ammunition in the DOS-applications we-love-to-hate debate. "Windows is tolerable because I don't have to give up any of my DOS apps," said Alfred Poor.

Often we love DOS because it does things Windows can't—namely, anything to do with low-level disk access and I/O. "All of your low-level Undelete utilities, like The Norton Utilities and PC Tools, are DOS-based," says Edward Mendelson. Defraggers and other disk utilities that write directly to the hardware can only be run in real mode, which is not possible under Windows. And Windows can't compare when it comes to diagnostic, network, or command line utilities.

"Windows programs good enough to make me weep include WinWord 2.0, Excel 4.0, and Freelance Graphics for Windows," says Seymour. But there are times when you'll want crossover: to use both the DOS and Windows versions of an application concurrently. With applications such as Quicken and Microsoft Word, the DOS versions do a better job of getting the real work done. The Windows version essentially becomes (pardon the expression) a fancy report writer.

"When I want to do serious writing," confides Seymour, "I always boot up Word 5.0—the glorious, pre-CUA (common user access) version." He likes the uncluttered screen, the keyboard shortcuts, and the fact that you can see large chunks of your text on-screen at once. Plus, you can really read the text (even proportional fonts on an SVGA display look ragged under Windows, with or without TrueType). Not to mention the fact that the Windows white background with black text can be unbearably hard on the eyes. Of course, Seymour will be the first to admit that the final draft makes its way to WinWord for beautification.

Lest we forget, Technical Editor Neil J. Rubenking put it all in perspective when we asked him what DOS does better. His reply? "Games, games, games!" □

Database Managers

BY SAL RICCIARDI

All of the major PC database vendors, including Borland and Microsoft, are continuing development efforts on DOS database products. Why is DOS still attractive? What about Windows? Is DOS a good platform for database management?

Paradox 4.0 has a new TurboVision-style user interface that features pull-down menus, overlapping windows, and mouse support. Most vendors are migrating their DOS database packages to support a more Windows-like look and feel.

According to the vendors, the biggest reason why DOS is still attractive is the high cost for customers of migrating to another platform. A large number of installed computers aren't equipped to handle the requirements of Windows or OS/2. If you're running an 80286 processor with 1MB of RAM (or for that matter, an 8088), a DOS database product or an expensive hardware upgrade are your only real options. DOS is cost-effective because it's the lowest common denominator and has the most modest hardware requirements. Customers with limited budgets who need to make maximum use of their existing equipment still turn to DOS-based solutions.

In addition to the installed hardware base, there's a large base of custom applications that have been developed using a DOS package like Borland's dBASE. Converting these applications to run under Windows would be time consuming and costly in terms of developer time and user training. As a result, many users are wary of embarking on such a project. Also, the third-party market for DOS database tools and development aids has had years to mature and thus offers a wide variety of products to choose from. Options are much less plentiful in alternative environments.

On the other hand, there are many customers who would prefer a Windows-based product, but the vendors have been slow to deliver. What's holding up the works? Many vendors didn't consider Windows a worthwhile investment until Windows 3.0 and 3.1 became available, and didn't really begin development in earnest until customer demand increased as a result of the increased success of Windows. Also, customers expect more from a Windows database application, such as support for DDE (Dynamic Data Exchange) and OLE (Object Linking and Embedding). Development of such complex products takes time. Still, every major vendor is hard at work on a Windows database product. The promised features of the Windows database packages and their ability to present a user-friendly interface and integrate with other Windows applications may well drive an exodus from the DOS-based database arena. Coupled with plummeting hardware prices, it seems inevitable.

TRENDS IN DOS DATABASES

There are certain database tasks for which DOS is well suited. Transaction-oriented applications with heavy data entry requirements that don't require graphics benefit from the speed of the character-mode interface. Screen refresh is much faster under DOS than under Windows (although that does not necessarily translate into faster overall throughput). Vertical-market applications, where the emphasis is on data entry and record keeping and not on graphics and application integration, are often good candidates for a custom application developed using a DOS database pack-

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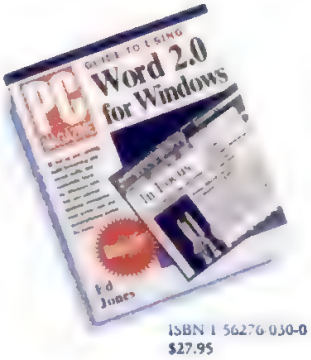

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age. Oftentimes a vertical application is the only software that will ever run on the machine. If your only use for a computer is to enter information into your store-management system, chances are a DOS-based solution will be cheaper than the alternatives.

There are two major trends in DOS database products. The first is toward providing a more Windows-like character-mode interface under DOS. Both Microsoft's FoxPro and Borland's Paradox 4.0 provide modern, mouseable, multiple-window interfaces with many of the gadgets made popular on the Macintosh and in Windows. For someone familiar with the Windows pull-down menu interface, learning how to navigate the user interface for either of these DOS packages is easy.

The second trend is toward taking better advantage of all of the memory installed in your computer. FoxPro does its best work when there is lots of expanded memory available, and the program comes with an extended edition for 386 users; Paradox 4.0 only runs in protected mode, where it can access all of your installed memory, and therefore requires at least an 80286 processor in your computer. With both products, you can often significantly improve performance simply by adding more memory to your machine.

A number of innovations have found their way into DOS database products in the recent past. Computer Associates' CA-Clipper introduced objects into the Xbase language for the first time. FoxPro's Rushmore data access technique dramatically improved performance for many types of queries. FoxPro was also the first to bring a programmer-friendly development environment to the DOS database world.

Meanwhile, Microsoft is hard at work on FoxPro 2.5, which will provide greater support for cross-platform compatibility. Computer Associates plans an interim upgrade to Clipper with new documentation, to be followed later by a new version that supports user-defined object classes. And Borland is working on new versions of dBASE IV, including a major new release that will offer Borland's trademark TurboVision-style user interface. With these new developments and the flurry of acquisitions that have occurred over the past year, there's plenty going on in the DOS database market. □

Solutions to Seven Common Problems

by Jeff Prosise

One key to boosting productivity in the DOS environment is understanding how to overcome some of its limitations. To compile a list of the most common problems that DOS users ask about, we checked with Microsoft technical support and reviewed the thousands of letters that have been written to *PC Magazine*'s Tutor column in recent years. Following are solutions to ten everyday problems—guaranteed productivity boosters that will make life with DOS just a little bit easier.

Problem 1: A 3.5-inch floppy disk drive isn't properly recognized by DOS, or it formats disks to the capacity of a 5.25-inch drive.

Solution: This often happens when you add a 3.5-inch drive to an XT-class PC or to any PC with an old BIOS. In many cases, just entering some standard DOS commands will render the drive compatible with your system. If DOS recognizes the drive (assigns it a drive letter), but the drive formats disks to the wrong density, add a DRIVPARM command to your CONFIG.SYS file to correctly characterize the drive. For example, if a 720K drive B: formats disks to 360K, add:

```
DRIVPARM=/D:1 /F:2
```

If that doesn't work, try adding a /I switch, as in:

```
DRIVPARM=/D:1 /F:2 /I
```

If neither command works, or if DOS doesn't even recognize that the drive is attached, try DRIVER.SYS. The command

```
DEVICE=C:\DOS\DRIVER.SYS /D:1 /F:2
```

added to CONFIG.SYS loads DRIVER.SYS from C:\DOS and tells DOS to create a drive letter for a 720K drive installed as the second floppy disk drive. If none of these solutions work for you, however, you may need a BIOS upgrade.

Problem 2: Num Lock is automatically enabled at start-up.

Solution: The setup screens of some PCs let you specify whether Num Lock should be enabled or disabled at start-up. If your PC does not offer this option, the following DEBUG script creates NUMOFF.COM, an 11-byte utility that disables Num Lock:

```
A 0100
MOV AX,40
MOV DS,AX
AND BYTE PTR [17],DF
RET

N NUMOFF.COM
RCX
0B
W
Q
```

Place NUMOFF.COM in a PATHed directory and insert the command NUMOFF in AUTOEXEC.BAT to turn Num Lock off at start-up.

To create a utility that turns Caps Lock on, change `AND BYTE PTR [17],DF` to `OR BYTE PTR [17],40` and `N NUMOFF.COM` to `N CAPSON.COM`. In all cases, be sure to include the blank line after the `RET` instruction.

Problem 3: You want to switch from the small (less than 32MB) hard disk

Asynchronous Communications

BY ANGELA GUNN

Graphical user interface environments are lovely to look at and delightful for swapping between, say, a spreadsheet program and word processor. But until further notice, there's simply no serious GUI competition in the asynchronous communications software field.

Only a handful of Windows communications packages exist. Software Ventures' Microphone II for Windows, the market leader, is a port from the Macintosh. Digital Communications Associates' Crosstalk for Windows, with its long list of support protocols, won our Editors' Choice (see the June 30, 1992, issue). The newest player is Procomm Plus for Windows from Datastorm Technologies. But when the beautiful program interface frames the old-fashioned, ugly terminal window, it all seems pointless. Part of the viability of DOS as a communications environment lies not with the operating system but with the inadequacies of cyberspace. Most bulletin boards and on-line services are modeled after the teletype machine, just as DOS is. No matter how dazzling your Windows communications interface may be, once you've moused your way to the dial tone, you're back to the keyboard.

Dedicated network access packages such as CIM (CompuServe Information Manager) can disguise this limitation. The teletype-style CompuServe responses are filtered by the software and presented to the user graphically. CIM's DOS-based GUI version is out now and the Windows version will be soon. But the Windows package does not have batch capabilities or other aspects of CompuServe's functionality—not a happy trade-off for power users.

DOS DOES IT BETTER

As a communications platform, DOS offers more than an absence of disadvantages. Connect time to a network can be expensive. If minimizing the amount of

partitions supported in DOS 3.3 to the large partitions supported in DOS 5.0.
Solution: There is no easy answer to this one. First, back up all the data on your hard disk. Then repartition the disk using FDISK and restore the backed-up data to the new partitions. You should note that SHARE is no longer required on disks with large partitions as it was in DOS 4.0.

Problem 4: EMM386 does not create enough UMBs (upper memory blocks) to load all my programs and device drivers high.
Solution: There are several possible solutions to this one. Most non-PS/2 users can gain an extra 64K of UMB RAM by adding an I=E000-EFFF switch to the line that loads EMM386. Most users who have VGAs and color monitors can safely claim another 32K by adding I=B000-B7FF. Test your PC thoroughly after adding these switches. If your PC locks up, or if you experience unexplained crashes, restore the original settings. And in all cases, have a bootable DOS 5.0 floppy disk on hand in case you can't boot from your hard disk.

If EMM386 is currently being loaded with a RAM switch, you can acquire 64K more UMB RAM by replacing RAM with NOEMS. The drawback to doing this is that EMM386 will no longer function as an EMS provider. Finally, if all else fails, you can sometimes fit more TSRs and device drivers into upper memory by varying the order in which they are loaded.

Problem 5: Your PC locks up when EMM386 is loaded or when a TSR or device driver is loaded high.
Solution: This usually happens because EMM386 has inadvertently created a UMB in a region of memory that contains ROM or adapter RAM. To determine if this is the case, start EMM386 with an X=C000-DFFF switch. If this eliminates the problem, experiment with different X= switches until you find the one that prevents lockups while excluding the least amount of memory.

Problem 6: DOS 5.0's EMM386 driver can't be used on a 286.
Solution: EMM386 only works on 386-based machines of better. But there are several third-party memory managers that will create UMBs on 286s built with chip sets that support shadow RAM, or on any PC that contains EMS 4.0 expanded memory hardware. These packages include QRAM (pronounced "cram") from Quarterdeck Office Systems, Move 'Em (part of 386MAX) from Qualitas, and NetRoom from Helix Software. Also, Chris Blum's UMB_DRVR .SYS, a shareware UMB driver available in Library 1 of CompuServe's IBMSYS Forum, works with many 286-based PCs.

Problem 7: I don't quite understand the difference between extended memory and expanded memory.
Solution: *Extended memory* is RAM that is located above 1MB on 286, 386, and 486 systems. The Lotus/Intel/Microsoft expanded memory specification (LIM EMS) has given rise to *expanded memory* (also called EMS memory): a special kind of RAM, usually installed on an EMS board, that a program can access on any PC with the aid of a software driver called an expanded memory manager (EMM). You don't have to understand the technical details associated with extended and expanded memory to use them; just pay attention to which (if any) your programs will use. Unfortunately, programs must be specially built to use extended or expanded memory.

A third type of memory, XMS (extended memory specification) memory, is closely related to extended memory. XMS memory is extended memory that has been placed under the control of an XMS memory manager, such as DOS 5.0's HIMEM.SYS. A small percentage of programs will use XMS memory (when present) to supplement their in-memory storage capabilities. □

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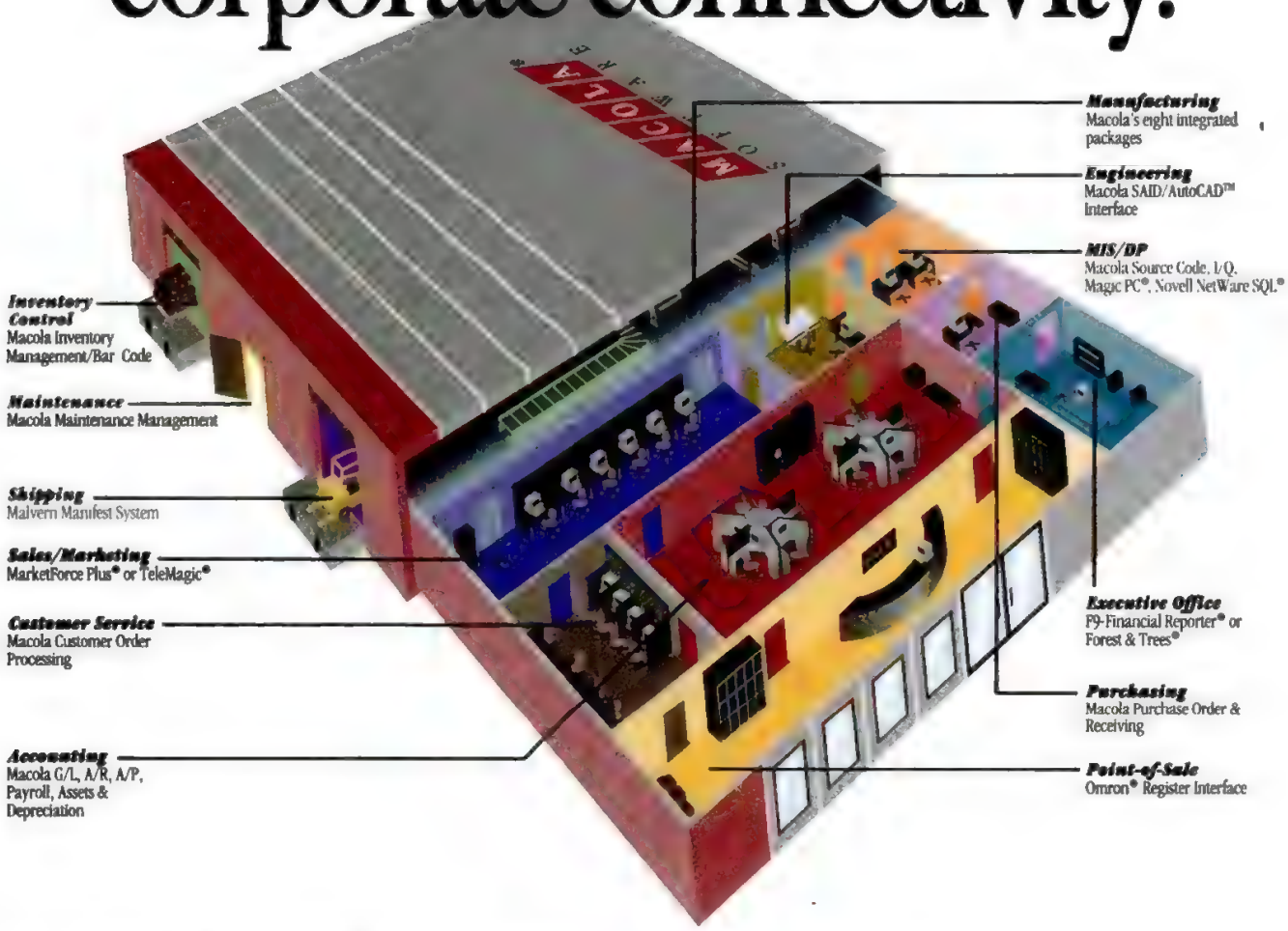

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time spent on-line is important to you, then a DOS-based product is a better choice than a Windows-based one. DOS-based communications software is not burdened by the overhead of Windows and talks directly to the hardware. This lets the computer complete its work as efficiently as possible.

Windows' ability to do background transfers is its major communications advantage. But the edge is dulled when cutting on-line time is a high priority. Background transfers can get slow and sloppy, with data bits spilling over the UART's buffer if you force your CPU to slice its time too thinly. Windows 3.1 does support the 16550AFN UART, which offers a bigger buffer to avoid spillover, but it is still not big enough.

The Procomm Plus Alt-key interface has proven popular among software designers. This screenshot shows how changes are made to the dialing directory through a submenu accessed by a single Alt-key combination.

Windows is also limited in the number of bits per second (bps) it can handle reliably, especially when multitasking. Until Version 3.1, Windows didn't support straight modem speeds over 2,400 bps or multiple COM ports, and support for communications still remains well behind hardware capabilities. The higher speeds offered with the Windows 3.1 communications driver don't work reliably in the background—not without a fair amount of "tinkering" with the PIF (program information file), something many users are loath to do. Bit for bit, Windows can't deliver the speed and reliability users have come to expect from communications packages. It's not inconceivable that communications software could be one of the last great DOS strongholds.

Users require communications packages to do a small number of tasks very well: They want speed, reliable transfer of data, and ease of use. So once users are comfortable working with one package they often become wildly partisan in preference, refusing even to upgrade to later releases of the same package. The DOS version of Procomm Plus, Datastorm's perennial bestseller, is regularly upgraded and represents some of the best communications-oriented programming on the market. Yet many users cling to earlier versions of Procomm—which, as ProComm, started (and continues) as inexpensive shareware. Several products on the market bear a strong resemblance to Procomm, including Mustang Software's Qmodem and Exis's Telix.

Of course, not everyone is entranced with the Procomm-style interface. Hilgraeve's HyperAccess/5 is incredibly fast (even on 286-based PCs) and uses a C-like procedural scripting language. The interface, which pops users directly to the dialing menu, is especially useful for novices. DCA's Crosstalk Mark 4 gives multiple-session capabilities and a user-definable dialing display.

INTERFACE BE DAMNED

For those users seeking pure speed, Omen Technology's Professional YAM (written by Chuck Forsberg, the inventor of the ZModem protocol) offers the ultimate command line environment: A stark interface that will daunt mere mortals but that can work near-miracles in the hands of the committed user.

In his user manual, Forsberg warns off users expecting "video arcade modem games." Pro YAM has no menus, no mouse support, no exploding windows; it does have state-of-the-art speed and error correction. Forsberg's attitude may seem unnecessarily anti-GUI (communications seems to attract a disproportionate number of efficiency purists), but as long as the innovators in the field hold this opinion, DOS communications software will continue to dominate. □

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Task-Switching Utilities

BY EDWARD MENDELSON

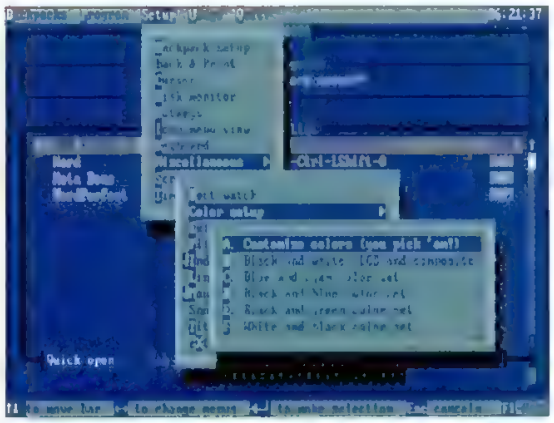
You don't need a GUI (graphical user interface) like Windows to keep more than one application open at a time. As early as 1985, character-mode DOS utilities were available that let you switch between open applications. If you were feeling ambitious you could even multitask, so that your database finished a sort in the background while you typed a report in the foreground. Today, the descendants of those early utilities let you maneuver among DOS programs with speed and grace that Windows and OS/2 often can't match.

The most significant DOS task switchers are Quarterdeck Office System's DESQview 386 ($219.90) and DESQview/X ($275), TModel Corp.'s Back & Forth Professional ($69.95), SoftLogic Solutions' Software Carousel ($89.95), and WordPerfect Corp.'s WordPerfect Office for DOS ($149).

The two DESQviews let you multitask; that is, they let you keep an application running in the background while you work in another in the foreground. The other programs let you task switch; only the foreground app runs while the others are swapped to expanded memory or to disk. All include features you don't get in the standard Windows package. For example, each lets you copy blocks of text from one or more applications to a clipboard and then paste the full contents of the clipboard to another application.

DESQview 386 is the most ambitious character-mode program switcher. It runs applications in resizable windows; but unlike Windows, it supports preemptive multitasking, which means that one application can't hold up all the others. DESQview's character-mode interface doesn't limit it to text-mode programs: It also runs DOS graphics apps and Windows apps (in standard mode).

DESQview 386 is surprisingly fast, stable, and compact. Its newest sibling, DESQview/X, has a graphics interface that slows it down and makes it almost as gigantic as Windows. But DESQview/X handles DOS applications in ways that Windows can't; its scalable Adobe Type Manager fonts let you zoom a DOS window so that the text shrinks and expands along with the window itself. DESQview/X is also unique in its peer-to-peer networking support.



Back & Forth's setup screens provide easy control over each program or DOS session. They are like Windows' PIF (program information files) editor, but are more extensive and easier to manage.

If you don't need resizable windows or multitasking, your most powerful and most flexible choice is Back & Forth Professional. This cleanly designed package (available as shareware on CompuServe's ZENITH Forum) lets you define up to 50 programs that you can run in separate DOS sessions—and keep 20 of them open at once! You may want to use Back & Forth even if you never run anything more than your word processor, because its macro feature can automatically expand abbreviations or correct misspellings as you type. It includes a scroll-back buffer for viewing text that has disappeared from your screen and an editor that doubles as a clipboard, plus a calendar, an address book, and calculators.

The best-known DOS task switcher, Software Carousel, has fewer features than Back & Forth and won't run with common utilities like DOS 5.0's DOSKEY. Its strongest feature is its clipboard, which can automatically reformat data copied from one application so that it pastes smoothly into another. On my system, where Back & Forth worked perfectly out of the box, Software Carousel locked up frequently until I made painstaking adjustments.

If you're familiar with the WordPerfect keyboard setup, the simplest and most flexible task switcher may be the Shell program included with the standard desktop utilities in WordPerfect Office for DOS. The Shell is effortless to set up and use; you don't have to specify how much RAM to allocate to different tasks, and the program doesn't open separate DOS sessions for each application. With WordPerfect Corp. programs and a few others, you can task switch with one keystroke. Other installed programs will switch to the Shell when you shell to DOS, and from there you can switch to any other installed program with a keystroke. Even if you don't use WordPerfect, you'll find the Shell highly compatible and ultrareliable. It's the DOS task switcher that does the job with the least bother and fuss. □

Applications Development

BY JEFF PROSISE

Theoretically speaking, it is the responsibility of the operating system to provide device-independent access to all system resources—an API (applications programming interface) for accessing disks, optical media, system memory, printers, video adapters, and so on. But the DOS API is woefully inadequate, forcing DOS applications programmers to write directly to the hardware to accomplish the most basic tasks or to rely on nonstandard functions provided by third-party vendors.

In contrast, the Microsoft Windows API includes all the basic, device-independent access functions that DOS *should* be providing, along with a host of interface-related functions. Windows provides one-stop shopping for a devel-

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For starters, COMPAQ-built, RISC-based controllers, along with powerful print engines, run our printers at 15 and 20 PPM. And at 20 PPM, that's an average of 100% faster than HP IIIsi in PostScript applications. Which helps keep your network's output more than up to speed.

Then there's the ability to print in sizes up to 11" by 17". Which can really make your day if it's filled with everything ranging from envelopes to double-page layouts to CAD plots to spreadsheets.

The built-in motorized paper trays can hold up to 1,500 sheets, more than any other desktop printers. Allowing you to put your time to far better uses than loading paper.

To Compaq engineers it simply wasn't enough for our printers to understand both PostScript Level 2 and PCL 5. Therefore, unlike other printers, ours have an Intelligent Emulation

YOU'D BE OUT OF A JOB.

Sensing feature that continually monitors, with radar-like precision, the language which anyone is using at any moment. It will then automatically adjust to that emulation, without your lifting a finger.

A truly network-ready printer should meet all of your network needs. This is why our new COMPAQ PAGEMARQ Laser Printers provide a direct connect to both Novell and AppleTalk environments, without the need for a print server.

The printers also offer you five interfaces, so that you can simultaneously run Ethernet or Token Ring, AppleTalk, both a serial and a parallel port, and even an Internal FAX Modem. Which will lead to better communication across the entire network. Rather than the kind of language that best remains unprinted.

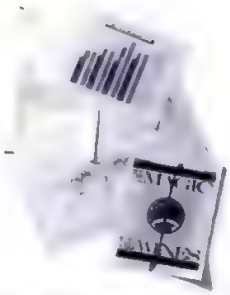
Completing the picture is the 800 x 400 COMPAQ High-Resolution Print Mode, created to give you exceptionally crisp text and graphics.

Both the Programmable Font Modules and internal 60-MB Hard Drive let you store PostScript fonts permanently, without having to constantly download.

Thus, what you've got amounts to far more than merely a network printer.

You have the brainchild of a company which holds the belief that utter chaos does not have to be standard operating procedure in your network.

For more on COMPAQ PAGEMARQ printers, just turn to the next page.



They print in sizes up to 11" by 17." They can handle CAD images, spreadsheets, and even double-page layouts. Multiple Twin-Trays hold up to 1,500 sheets. Impressed?

Our Intelligent Emulation Sensing feature continually monitors, then automatically adjusts to either PostScript Level 2 or PCL 5 depending upon which language you're using. You needn't lift a finger.

COMPAQ

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COMPAQ PAGEMARQ 15: *15 PPM ◂ 16-MHz AMD 29000 RISC ◂ 4MB RAM standard, expandable to 18MB ◂ 750-sheet (standard), 1,000-sheet max w/ optional second TwinTray*

BOTH MODELS: *Up to 800 x 400dpi (COMPAQ High-Resolution Mode) ◂ PostScript Level 2 and PCL 5 w/Intelligent Emulation Sensing ◂ One slot/port each for AppleTalk, Network Interface Cards, Internal FAX Modem, Serial and Parallel Port ◂ Available Options: Internal 60-MB Hard Drive, 1- and 2-MB Programmable Font Modules ◂ Consumables: One-piece cartridge w/12,000-page yield*

At Compaq, we realize even the most advanced network printers in the world aren't worth the toner in their cartridge kits if you can't get the service or the parts that you need whenever you need them.

Thus we've designed CompaqCare. This is our comprehensive service and support program which includes our one-year free on-site* limited warranty.

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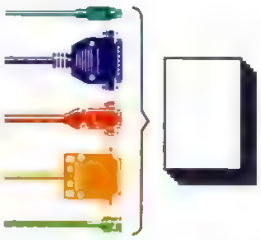
For any questions, or to learn more about our new program for recycling consumables, phone our hotline at 1-800-345-1518 in the U.S.; in Canada, call 1-800-263-5868.

You'll find dedicated printer specialists eager to convince you that the path to greater network productivity begins not only within yourself, but along the paper path that is inside your COMPAQ PAGEMARQ Laser Printer.



Five interfaces, with a direct connect to Novell and AppleTalk, lets you simultaneously run Token Ring or Ethernet, AppleTalk, a serial and parallel port, plus an Internal FAX Modem.

Store PostScript fonts forever. Expand your font library. And eliminate constant downloading with Programmable Font Modules or the internal 60-MB Hard Drive.

With our printers' optional Internal FAX Modem, you can send and receive presentation-quality documents, in sizes up to 11" by 17". Right from your desktop.

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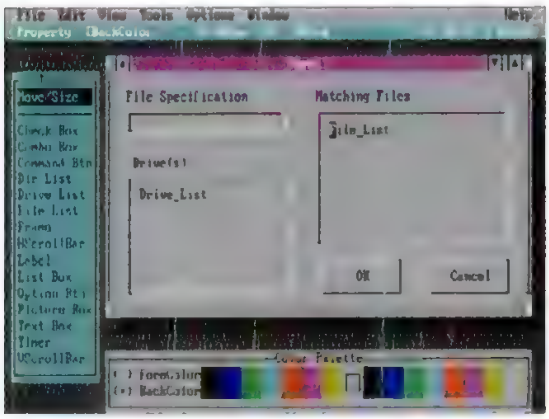
oper's every programming need. But there is a downside to Windows' all-inclusive personality: Windows programs are more difficult to develop. Programming for Windows requires a knowledge of a complex API encompassing hundreds of different functions and messages, and it calls for specialized developmental tools such as resource compilers and icon editors.

DOS programming is simple by comparison: Buy a compiler, learn a couple of dozen different API functions, and you're off and running. You can even use the QBasic interpreter bundled with DOS 5.0 or, if you're brave enough, write useful utilities using the assembler built into DEBUG.

WHAT DOS LACKS

From a programmer's perspective, DOS's greatest shortcoming is that the API provides meager support for hardware devices other than disk drives. For example, if you write a DOS application that uses the printer, it's up to you, the developer, to supply drivers for the hundreds of printers on the market. This requires precious development time that could otherwise be spent writing code for the application itself. In contrast, Windows supplies all the printer drivers for you. If Windows doesn't come with a driver for a particular printer, chances are the printer's manufacturer will supply one. And thanks to Windows' high-level GDI (Graphics Device Interface), the same set of routines will produce identical output on the screen or printer.



In Microsoft Visual Basic for DOS, you design the forms that make up a program and then apply code to the controls on the forms. Shown here is the forms design screen for a program under development.

DOS programming can be more difficult because so little is done for you, but it doesn't have to be so. Many DOS programmers have built up libraries of routines over the years and prefer using the tried-and-tested routines they're comfortable with to the tedium of learning the Windows API. Furthermore, there are hundreds of third-party programming libraries and other add-ons to help ease the chore of developing DOS applications. You can buy user interface libraries to paint your application with a pretty face in text or graphics mode. Printer driver libraries (such as the SLATE Universal Printer Driver with Graphics) let you write to all printers with one set of code. Graphics libraries and database libraries provide improved screen and data management capabilities, and DOS extenders smash the 640K barrier, allowing DOS applications to reach into the vast expanse of protected-mode memory.

DOS programming can be more difficult because so little is done for you, but it is precisely DOS's hands-off attitude that keeps many programmers coming back.

In fact, it is DOS's hands-off attitude that keeps many programmers coming back. Some enjoy the greater feeling of control they get when "programming the hardware" and balk at the complex layer thrust between them and the machine by the Windows API. Programming at a low level provides significant performance benefits. Character-mode DOS applications are fast—lightning-fast—compared with Windows applications, so you don't need a 386 and a graphics coprocessor to run them. Even graphical applications run faster under DOS. One example: Autodesk's DOS app AutoCAD, Release 11, repaints the screen about four times as fast as does AutoCAD, Release 11, Extension for Windows.

Some programmers view Windows' common user interface as limiting. DOS programmers are not constrained by someone else's notion of what a user interface should look like. If you write the application, you write the interface, too. DOS programmers have produced some great interfaces over the years, including Datastorm Technologies' Alt-key interface (with exploding windows!) in its Procomm packages and WordStar International's Ctrl-key commands in the WordStar offerings, which are still mimicked in some text editors.

BORROWING FROM WINDOWS

Ironically, the year's most innovative development in DOS programming comes straight from Windows. Visual Basic for DOS (VBD), a port of Microsoft's popular Visual Basic for Windows, makes it easy for BASIC programmers to develop Windows-like programs for DOS, complete with a mouse interface and standard controls such as push buttons, radio buttons, and scroll bars. As in Visual Basic for Windows, a developer just defines a set of forms that make up a program. Then simply write BASIC code to correspond to events (such as button clicks and key presses) and VBD does the rest. If you haven't programmed Windows before, VBD requires a whole new way of thinking. But it also adds a powerful new paradigm to DOS programming that was formerly the exclusive domain of event-driven environments such as Windows.

Among other things, VBD provides a simple conversion utility to port Windows programs written in Visual Basic for Windows to the DOS environment, and vice versa. In fact, if you avoid certain facilities (such as Windows' Dynamic Data Exchange) that are not common to the two environments, you can easily write a program that will run without modification under both DOS and Windows. Now that's power—and a glimpse of great things to come for developers who are currently doing double duty supporting DOS and Windows versions of their products. □

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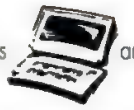
You know the story. Your meeting's in 10 minutes  and your most important file is 10 time zones away.

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THE BEST UTILITIES

Essential Tools

by Joel Dreyfuss

The words *computer* and *frustration* have always been closely linked. From the time the infamous DOS prompt first blinked on the green screen of the original IBM PC, computer users started to gnash their teeth and pound their fists over tasks their computer made hellishly difficult or nigh impossible.

The most simple tasks—copying files, backing up data, moving directories, reading the contents of a file, finding a specific file or group of files—were simply harder than they had to be. Fortunately, computer users didn't throw up their hands and submit to the limitations of their operating systems. They opened their manuals on assembler and BASIC, worked into the wee hours of many days, and came up with programs that performed common operations more easily than the authors of the operating system seemed to have imagined possible.

There has been a lot of progress in the quality and quantity of software available to the computer user since the early days of the PC. But "DOS Lives" (in this issue), and we still have to find ways of coping with a 10-year-old operating system. And new applications have brought us new needs. Utilities remain essential tools for anyone who is more than an occa-

Our editors list the utilities you want to have in your toolbox when you do some very serious computing.

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Photography by Scott Wippermann

sional computer user. They automate repeated processes, make dull tasks bearable, even fun. They save us from our worst mistakes and from the endless treks to the bookshelf for manuals that should be there—but aren't. In an age when Windows and OS/2 have unshackled computer programs from the 640K DOS limit, applications threaten to swamp our machines with giant files. Most of these utilities are a welcome throwback to an age of economy: small, well-written and single-minded.

TOOLS, NOT APPS

We asked our *PC Magazine* experts to name their favorite utilities—the programs they would want to have with them if they were stranded on a desert island (with enough batteries or electric power to run their computers, of course). For the purposes of this article, we have defined a *utility* as a program that performs a function that should (or might) have been a part of the operating system. Our utilities are tools that extend the native operating system (or in the case of Microsoft Windows, the operating environment). They are not applications, although several on our list, such as Lotus's Magellan and NoVaSoft's CMFiler, have so many functions that they come close to crossing the line. We reluctantly rejected some of our favorites because they did fall into the applications category: personal information managers, although some of us couldn't imagine life without them (on or off a desert island); telephone dialers; text editors; and integrated applications.

DOS's austere command-line concept cried out for a more imaginative approach to its basic functions—and the utility writers responded with grace and integrity.

Most of the products on our list are DOS utilities. That shouldn't be surprising. DOS's austere command-line concept cried out for a more imaginative approach to its basic functions. Ten years with the blinking curse, er, cursor gave computer users a long time to find the shortcuts and solutions they desperately needed.

Although Windows was touted as the operating environment that would answer all of DOS users' prayers, it is already spawning its own cottage industry of little helpers. As fast as you can say Visual Basic or C++, bulletin boards have been filling up with utilities that do Windows better than Windows, often performing the same file-handling and applications-launching functions that our DOS utilities perform and a few new ones that wouldn't be possible under DOS. We expect to see the same burst of creative problem solving with OS/2. The tradition of the utility lives on in the graphical environment. And thank goodness for that. We wouldn't want to depend solely on the geniuses in Redmond and Boca Raton to make our computing lives easier.

GOOD TRY, BUT NO CIGAR

If imitation is flattery, then many of the utility authors on our list have won the plaudits of far bigger competitors. Many of their functions are now available in DOS or Windows. The command line stacking and aliasing functions of PCED and 4DOS have been duplicated—more or less, but mostly less—in DOS 5.0. Many of the easy-to-use operations that file managers brought to DOS turned up in DOSSHELL, an early IBM effort to improve ease of use, starting with DOS 4.0. Microsoft licensed an unerase utility from Central Point Software for DOS 5.0. Microsoft's HIMEM.SYS and EMM.SYS are pale reflections of the powers that NetRoom, QEMM-386, and 386MAX provide.

In a few cases, products that started as shareware utilities have crossed the line successfully into the commercial market. An earlier version of 4DOS was included with The Norton Utilities as NDOS. Symantec also licensed Winbatch, a Windows batch language, from shareware company Wilson WindowWare for its Norton Desktop for Windows. Even LIST, Vern Buerg's venerable file viewer, recently made the jump into commercial distribution after years as one of the most widely used shareware programs.

In most cases, the utilities have not handled the leap to the big time very well. Shareware utilities tend to focus on a single function: file viewing (as with LIST), file management (as with CMFiler), or archiving (as with Shez). Successful commercial utility packages such as Symantec's The Norton Utilities and Central Point Software's PC Tools have been Swiss Army knives: complex packages that offer everything from file management to file recovery to text editing and communications. In theory, this should provide the user with a more consistent interface. In practice, most users probably never use most of the features available in an integrated package, but they are often willing to pay the higher price for a commercial package because of the implied value of all those features.

The loving care a utility needs to succeed may be beyond the capacities of large companies accustomed to markets where hundreds of thousands of copies are sold. For example, in his review of Magellan, Jim Seymour laments the lack of attention the vendor gave the package. Magellan's market was probably much too small for Lotus to care much about—although pitching the $139 package as a file retriever may be one reason it failed to capture a larger audience.

The only multiple-function utility that made it onto our list is The Norton Utilities, mostly because of its undelete function. In declaring their affections for their favorite utilities, most of our experts have stuck with one-function programs because they are more elegant or simply better than the all-in-one packages.

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COMMAND LINE ENHANCERS

What Was that Command?

We've grouped the selections in this article into several broad categories. The command line enhancers, such as PCED and 4DOS, extend your capacity to issue commands from the C: prompt, which—although a frequent source of high blood pressure—gives DOS its best advantages: speed and simplicity. A single typed word can perform miracles. These programs make computing easier, by remembering what you typed earlier, completing commands from a few letters, or letting you substitute a favorite abbreviation for a long string of complex commands that you use frequently.

JP Software Inc.

4DOS

BY EARLE ROBINSON

There's no escaping the notorious DOS prompt, even if you spend most of your time in Microsoft Windows or OS/2. When the time comes that you need to issue a DOS command, you're at the mercy of DOS's not-so-smart command interpreter, COMMAND.COM. JP Software's 4DOS ($69) is a shareware replacement for COMMAND.COM that runs under any version of DOS and Novell's DR DOS, and even in a DOS box in Windows. It makes command line work less of a chore; 4DOS can even make it a pleasure.

Installed in place of COMMAND .COM, 4DOS frees 4K or more of precious conventional memory for applications. Context-sensitive help screens are available by hitting the F1 key at the DOS prompt, and the program will even display examples of the proper command syntax.

4DOS is simply smarter than COMMAND.COM. It enables you to list, copy, delete, or move multiple files and file types with a single command. For example, typing DIR *.COM *.EXE will give you a list of both types of files. 4DOS offers a true Move function, avoiding the copy/delete steps that DOS demands. You can set up 4DOS to ask for confirmation, even for individual deletions or copies. 4DOS also allows the stacking of keyboard commands, allows aliases for common commands, and provides an internal file browser. You can add descriptions to files that show up when you run a directory listing and create elaborate menus with 4DOS's internal functions.

4DOS is the thinking man's shell. It lacks the glitz and pretty screens of the typical commercial shell program, but it does the jobs they do without encroaching on conventional memory. It is fully compatible with Windows and DESQview, and the company has also issued a version for OS/2 called 4OS2.

4DOS, Version 4.01 *JP Software Inc., P.O. Box 1470, E. Arlington, MA 02174; 800-368-8777, 617-646-3975; fax, 617-646-0904. List Price: $69.*
Circle 465 on reader service card

Buerg Software

LIST Enhanced
LIST Plus

BY EDWARD MENDELSON

LIST Plus, Buerg Software's $37 shareware file viewer, is the utility that expert DOS users probably rely on more than any other. With LIST Plus, you can view files of up to 32MB in normal or hex mode at startling speed, page through a group of files and search for the same text in each file, scroll automatically through a file, or split the screen to display two files at once. You can also mark a telephone number in a file and make LIST Plus dial it, copy or print all or part of a file, and generally do virtually everything else that you can imagine doing to a file—except edit or damage it.

The few DOS experts who don't use LIST Plus have probably switched to LIST Enhanced, the $99 commercial version. This version is almost identical to its shareware sibling, but lets you view database files in readable format, lets you choose directories from a tree display, and gives you greater screen control and customization options.

After a few minutes with either version of LIST, the program feels as flexible and comfortable as an old shoe, but the help screens make it clear that LIST's modest interface conceals a vast range of functions and conveniences. Unlike the high-tech file viewers found in The Norton Desktop for DOS or PC Tools, LIST won't display files in their native format. But when you need to find data quickly, LIST gives it to you faster and with less trouble than any other program ever written.

LIST Enhanced, Version 1.84; LIST Plus, Version 7.6B *Buerg Software, 850 Petaluma Blvd. North, Suite F, Petaluma, CA 94952; 707-769-5478; fax, 707-769-5479. List Price: List Enhanced, $99; List Plus, $37.*
Circle 466 on reader service card

The Cove Software Group

PCED

BY EDWARD MENDELSON

PCED makes the DOS command line a pleasure to work with, instead of a constant frustration. The Cove Software Group's $50 command-line enhancer performs tricks as simple as recalling and editing commands used earlier in a session, and as complex as creating batch file-like commands that run different programs depending on the extension of the file you enter as a parameter.

PCED loads as a 24KB TSR utility (4KB if you have EMS and don't use Microsoft Windows). You can start enjoying it even without opening the manual: Just use the cursor keys intuitively to edit DOS commands and scroll through earlier ones. After a few minutes with the manual, you'll learn how to save all of today's commands for reuse later, how to create shorthand replacements for long pathnames, and how to nest batch-like command sequences.

One of half a dozen add-on programs in the package lets you review data after it scrolls off the screen and capture text screens to view later or save to a file. Another displays directories in customizable

colors. Others speed directory navigation and screen display.

You can find many of PCED's features in other utilities, ranging from the primitive DOSKEY included with DOS 5.0 or JP Software's elaborate COMMAND.COM replacement, 4DOS. But nothing matches PCED's convenience, compatibility, and customizability—or its ability to stay invisible when you don't need it.

PCED, Version 2.1 *The Cove Software Group, P.O. Box 1072, Columbia, MD 21044; 410-992-9371. List Price: $54.50 (includes shipping).*
Circle 467 on reader service card

FILE MANAGERS

Files, Files, Everywhere

File managers do what DOS has always done badly—manage the files on your hard disk. And the DOSSHELL that Microsoft finally added in Version 4.0 doesn't come close to having the features that our editors' favorite file managers offer. All these programs end the inscrutability of DOS when it is confronted with a list of files. They offer you neat lists of files to work with—and let you do what you will to them. Most of these programs will let you tag a group of files to copy, move, or delete; create directories on the fly; or prune an entire directory and its subdirectories and re-create the structure somewhere else. These file managers will run a program against a list of files they present to the screen.

NoVaSoft

CMFiler

BY EDWARD MENDELSON

CMFiler is a DOS file manager with a bundle of unusual features. NoVaSoft's $30 shareware utility proves that a programmer working alone often offers features that major commercial vendors never thought of. If you want to keep track of obscurely named data files, or the even more obscure files spawned by Microsoft Windows applications, CMFiler lets you annotate filenames with 40 characters of text. Unlike most other file-annotation programs, CMFiler lets you view, edit, and delete your files from the same screen that displays your notes. You can even keep two directories open and switch between the annotations for each.

This versatile and reliable package includes other features that you won't find even in utilities as advanced as XTreeGold. One option lets you select a program and then tag a file to use as its parameter. The program remembers the last program you used, so you can easily run a series of programs on the same file without reentering the filename.

You can choose whether to delete files permanently or to move them into a storage directory for safekeeping. Tagged files can be automatically compressed into ZIP files. You can map the function keys to launch applications. CMFiler's interface isn't elegant, and some advanced features are tricky to learn, but it works at breakneck speed, and the company responds quickly to requests for features and improvements. For DOS users, this program is a valuable and flexible convenience. For Windows users, their disks littered with stray files, it's a necessity.

CMFiler, Version 5.32 *NoVaSoft, 3239 Riverview Dr., Triangle, VA 22172; 703-221-1471. List Price: $30.*
Circle 468 on reader service card

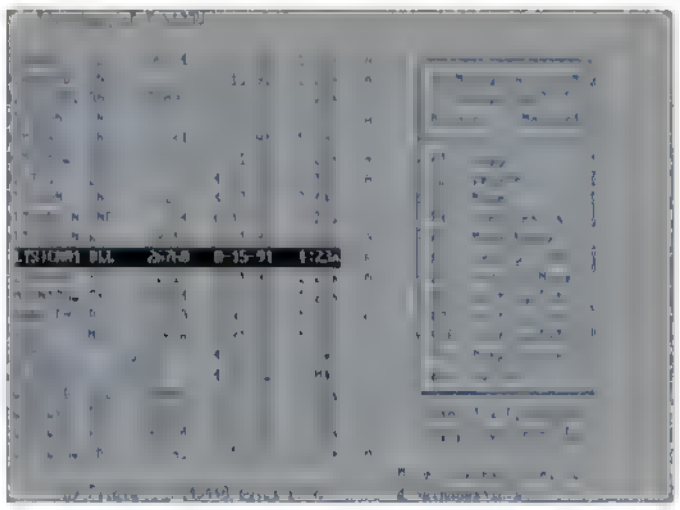
Ziff Communications Co.

CO
DIRMATCH
DR
RN

BY CHRISTOPHER BARR

Although there are hundreds of *PC Magazine* utilities to choose from, the most popular are some of the oldest DOS programs written by a master of assembly language: Michael J. Mefford. DR, RN, CO, and DIRMATCH are among the smallest, fastest file- and disk- management utilities you'll find. They're small because they were written in assembler. The first three were originally written in 1987—before the term *user interface* became synonymous with ease of use and GUI—and what they lack in user interface, they make up for in streamlined functionality. In other words, they use the command line.

DR is a file-management tool that lets you sort, view, rename, delete, or move files. It is only 3K, and when invoked, DR pops the current directory, sorted alphabetically on-screen. You can use the command line switches /E, /S, /O, /D, or /T to have the initial display sorted by extension, size, DOS DIR order, or date.



One of the original PC Magazine utilities, CO makes file management a matter of pointing and shooting.

RN is the directory manager that can be used either standalone or loaded into memory as a TSR for added speed. RN lets you create, delete, change, rename, and hide or unhide directories. It reads the directory structure of the current drive and pops an alphabetized tree on-screen, highlighting the current directory. RN has the same interface as DR, and the function keys let you manipulate the highlighted directory.

Besides the standard create, rename, and change directory commands, RN lets you toggle the archive bit on or off, and it can mark all the files of the directory as read only. F4 will delete a directory and all the files in it; F9 shows the file count of a directory and the space used; and F10 calls DR, if you have it, which can be used to manage individual files.

CO, the last of the trio, is the copy utility that looks and acts like the other two. It works within the current directory and copies, moves, or deletes files individually or in tagged groups.

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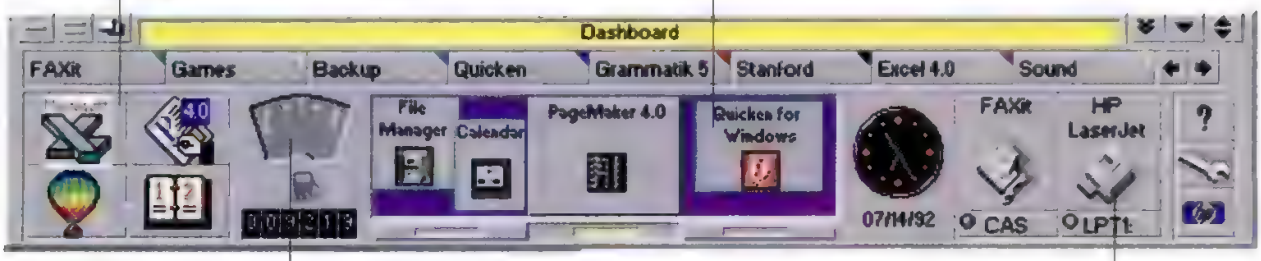

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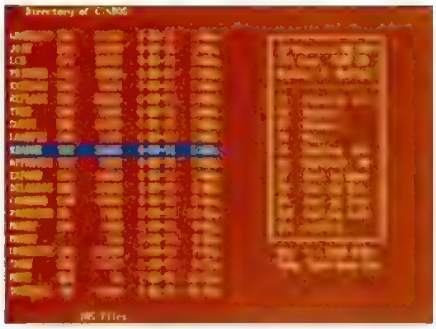

PC Magazine's DR utility pops up the current directory, sorted as you like it, while DIRMATCH lists two directories side by side.

DIRMATCH is another Mefford gem that shows two scrollable, alphabetized directory listings side by side. Matching files are highlighted so you can mark, copy, and move them to a target directory. Unlike DR, RN, and CO, DIRMATCH has a beautiful character-based interface, which makes sense, considering it was originally written two years after the first three utilities were. DIRMATCH has been enhanced with additional file-management commands.

All *PC Magazine* utilities are available on PC MagNet. They are free, although you'll have to pay the connect charges and ZiffNet membership fee to obtain them. Or send a postcard to Katherine West at *PC Magazine*, requesting that the utilities be sent to you on-disk, free of charge. For information on PC MagNet, see page 12 of this issue.

CO, Version 1.0; DIRMATCH, Version 3.1; DR; RN, Version 3.0 *Ziff Communications Co., One Park Ave., New York, NY 10016. List Price: Free.*
Circle 469 on reader service card

Knozall Systems Inc.

FileWizard

BY FRANK DERFLER, JR.

Although hardware prices keep plummeting, the large hard disk in a network file server remains an expensive resource that deserves close management. FileWizard, from Knozall Systems, lets you find the unused, duplicate, outdated, and otherwise wasteful files on a NetWare server and do something about them.

Instead of raw statistical data, FileWizard creates colorful charts depicting how much data or how many files each authorized user stores on the server's drive, how much activity each file receives, and other combinations of useful information. On informal tests, it took approximately two minutes to develop the report data on a 250MB NetWare volume. The program will print out easy-to-read reports, but the charts tell the story at a glance.

Because it is more than just a monitoring tool, a network administrator can use FileWizard to archive and delete categories of files. The program keeps lists of the files that meet specific criteria you establish before the scan and makes it easy to take actions on the files in those lists.

FileWizard has the unique ability to project future requirements from past performance. The program can take all available history and generate a chart showing when you will run out of disk space. This useful tool can help justify strict administrative controls or support a budget request for more hardware. Knozall's utility is a powerful spyglass in a network manager's bag of tricks.

On informal tests it took FileWizard approximately two minutes to develop the report data on a 250MB NetWare volume.

FileWizard, Version 2.12 *Knozall Systems Inc., 375 E. Elliot Rd., #10, Chandler, AZ 85225-1130; 800-333-8698, 602-545-0006; fax, 602-545-0008. List Price: single server, $395; three servers, $595; eight servers, $995. For NLM versions: single server, $495; three servers: $695.*
Circle 470 on reader service card

GammaTech Inc.

GammaTech Utilities for OS/2

JOE SALEMI

Among the many advances OS/2 brings to PC operating systems is a replacement for the DOS FAT storage system. However, because OS/2 does multitasking and virtualizes all disk accesses, DOS-based disk utilities such as Norton's Unerase or Disk Doctor won't work under it. OS/2's High Performance File System (HPFS) stores files more efficiently than FAT, but regular DOS can't read disks that are formatted with HPFS. Those who moved to OS/2 had to give up some important functions available through their DOS disk utilities.

GammaTech's $125 GammaTech Utilities for OS/2, which works with Versions 1.3 and 2.0 of OS/2, has solved this problem. The most important utilities are an HPFS disk defragmentation program and an Undelete program that works on FAT or HPFS disks. The disk optimizer uses HPFS's built-in ability to avoid fragmentation. HPFS will analyze your hard disk and copy entire files to less fragmented areas of the disk rather than physically move portions of the file around as DOS optimizers do.

Though OS/2 2.0 has a built-in delete-protection utility that saves a copy of the deleted file in a hidden directory, GammaTech Utilities' Undelete function has the added advantage of working even if you don't enable OS/2's function. It also works with OS/2 1.3, as well as the HPFS386 included with Microsoft LAN Manager and IBM LAN Server software.

Other utilities in the package test your disk for bad sectors, completely delete files by overwriting them to government security specifications, and give you the ability to edit a disk sector directly. There is also a directory-listing function that gives complete information about the contents of the disk and uses OS/2's Extended Attributes to let you add comments about the contents of a file to the disk, and a file-finder that uses Boolean logic to search for files by date.

Until Symantec or Central Point Software come out with OS/2 versions of their disk utilities, GammaTech Utilities is your only protection against disk problems.

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486SX/25	Intel 80486SX-25 MHz Built-in 8K CPU cache	4 standard 8 & 20 options	80	2.5+	$2,199 $81/mo*
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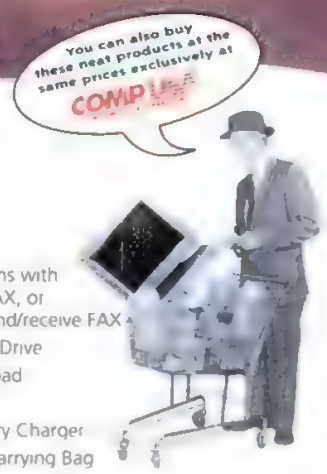

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GammaTech Utilities for OS/2, Version 1.3 *GammaTech Inc., P.O. Box 70, Edmond, OK 73083; 405-359-1219; fax, 405-359-7391. List Price: $125.*
Circle 471 on reader service card

Traveling Software Inc.

LapLink Pro

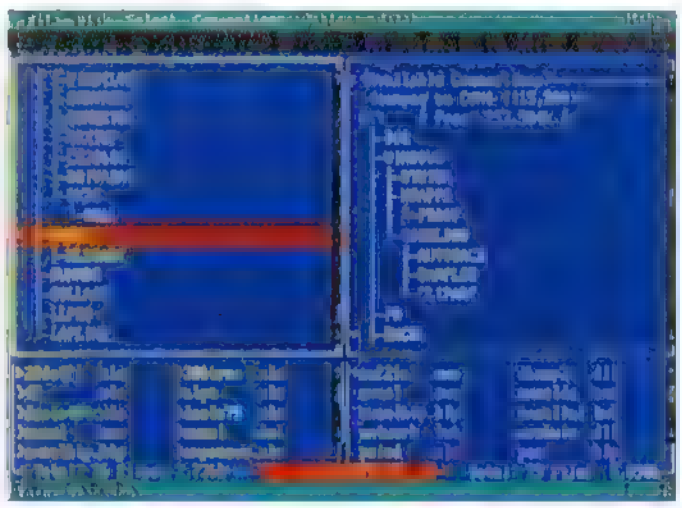
BY BRUCE BROWN

Transferring files from one computer to another with floppy disks can be a tiresome and error-prone process. Portables without floppy disk drives add their own file-transfer challenges. LapLink Pro provides good solutions to both problems.

With LapLink Pro ($169.95), you can quickly move single files or entire directories from one system to another, either with a cable that connects to a serial or parallel port or via telephone lines and modems.

LapLink Pro's simplest function is to move files from one computer to another. As the program has evolved, a broad set of functions has been added. Current features include a serviceable text editor, remote program installation via cable or modem, good file and disk management, drive cloning, real-time file compression during transfers, and subdirectory synchronization. Synchronization lets you create identical subdirectories on two computers, each with the most recent files available on either system.

If you use a portable computer and have to move files regularly between computers, or if you want a convenient way to transfer numerous files between desktop systems, LapLink Pro, with its ease of use and rich list of features and functions, can do it well.



LapLink Pro simultaneously displays directory trees and filenames for each linked device.

LapLink Pro, Version 4.0c *Traveling Software Inc., 18702 North Creek Pkwy., Bothell, WA 98011; 800-343-8080, 206-483-8088; fax, 206-487-1284. List Price: $169.95.*
Circle 472 on reader service card

Lotus Development Corp.

Magellan

BY JIM SEYMOUR

The great sailor, explorer, and navigator Ferdinand Magellan may never have foundered, but the product carrying his name seems to have. Created by Bill and Larry Gross, who earlier produced the Lotus 1-2-3 aid HAL, Magellan knocked PC users off their feet when it appeared in 1989. But from the beginning, Magellan was a stepsister at Lotus, lost first in the shuffle of rushing a very late 1-2-3 3.0 to market, and thereafter lost, period, at a company that didn't know how to sell a $100 product that could have been a $100,000,000 hit.

Magellan, a Lotus orphan, is the best toolkit for finding those needle-in-a-haystack files.

Magellan is the best toolkit for finding those needle-in-a-haystack files you know are there *somewhere* on your hard disk. It builds remarkably compact indexes of everything on the disk—or of only a few directories, if you prefer—then searches them with amazing speed and smarts. Magellan posts a list, rank-ordered by the probability that the files it has found are the ones you want. It also shows you those files, via 45 file viewers. There are other goodies, such as built-in PKZIPping and UNZIPping, but its fast searches and excellent viewers made Magellan's reputation.

Unfortunately, Lotus has let the product drift for years, and these days it seems more interested in moving Magellan's technology into its other products than in selling The Real Thing. Magellan is *available*, but that's about it. New viewers for new DOS apps? A Windows version, or at least updated viewers for new Windows apps? Don't even ask: This one's DOS, circa 1988, all the way. And it's still one of the very best reasons to live in the aging world of DOS.

Magellan, Version 2.0 *Lotus Development Corp., 55 Cambridge Pkwy., Cambridge, MA 02142; 617-577-8500. List Price: $139.*
Circle 473 on reader service card

Symantec Corp.

Norton Commander

XTree Co.

XTreeGold

BY M. DAVID STONE

It is still true that you can't always get what you want, but if you are willing to compromise, you can come pretty close. Consider, for example, Symantec Corp.'s Norton Commander, Version 3.0, and XTree Co.'s XTreeGold, Version 2.5, two strong contenders among DOS shell and disk-management utilities.

Each program lists for $149, and each overlaps in large measure with features that should have been in DOS in the first place. Both will let you rename directories; manage any number of arbitrarily tagged files; sort files by name, extension, size, or time; display the directory tree; list only those filenames that match a filter; view or edit files; and so on.

Each program also offers something the other lacks: Norton Commander, for example, provides LapLink-style file transfer (a feature that XTree says it will soon add), while XTreeGold, which has more file-management tools, will show a single list of all files on your disk or disks—an invaluable feature when you remember a filename but can't remember where it is. (XTree also offers XTree-Net, for $495 per server and $100 for each server extension, which provides file-management features over a network.)

Even where features overlap, each program manages some functions more elegantly than the other. In particular, you can set Norton Commander so it will load quickly—almost instantly on a 486/25—and automatically show two directories. You can then change either one or

Travelling Utilities

by Bill Howard

Portable and notebook computers benefit from most of the utilities described in this article, especially Stacker 2.0's disk-capacity doubler and LapLink Pro's file-transfer utility. They also have a few special needs of their own. Here are a handful of utilities that make life with a laptop more palatable.

Many laptops leave blank one sixth of the already-limited height of your display, because VGA text mode produces 400 lines of pixels, not 480 (480 is for VGA graphics mode). Laptop UltraVision ($99.95), from Personics Corp.(Wilmington, Massachusetts; 800-445-3311, 508-658-0040), restores the full height of your display and lets you choose from 22 screen fonts. Some are silly (you really wanted Old English on a laptop?), but several provide significantly bolder fonts. Laptop UltraVision is a different product from the desktop version; you can't substitute one for the other. The laptop version will turn a color CRT display shades of red and purple; the desktop edition doesn't expand an LCD screen. If you buy only one laptop utility, make it Laptop UltraVision.

If you use Microsoft Windows and can't see the tiny mouse cursor, you can choose from more than a dozen utilities that increase the cursor size and leave "vapor trails" to help you track movement on slow-to-respond LCD panels. Check with the maker of your pointing device. For example, the Microsoft Mouse Software 8.1 device driver, which also works with the BallPoint trackball, is free to most registered users, and provides multiple cursor sizes.

Also check on-line services for free or low-cost cursor utilities. One example is *PC Magazine*'s free WINPTR. To find these utilities, browse the Utilities/Tips Forum on PC MagNet, searching on the keyword *cursor*. (Type Go UTILFORUM, then BRO KEY: CURSOR LIB: ALL.) Or try one of these commercial utilities: Magic Cursor! ($49.95), from Fanfare Software (Northridge, California; 818-886-8787), or Cursorific! ($49.95), from AApex Software Inc. (Reno, Nevada; 800-728-7650). If you're not carrying a mouse, NoMouse for Windows ($49.95), from Abacus (Grand Rapids, Michigan; 800-451-4319, 616-698-0330), lets your keyboard double as a mouse.

Eye Relief for Laptops ($129.95), from SkiSoft Publishing Corp. (Lexington, Massachusetts; 800-662-3622, 617-863-1876), is a limited-function text editor that makes what you're typing up to four times bigger than normal text characters. Eye Relief for Laptops will be a blessing for the new generation of subnotebooks that don't have illuminated screens; on illuminated-display notebooks, it lets you turn the brightness down and conserve battery life (the display eats up half your notebook's power). While you can print from Eye Relief for Laptops, you're better off exporting to a grown-up word processor if you want to add type attributes or multiple fonts. SkiSoft also makes No-Squint II, a $49.95 utility that enlarges the cursor in DOS applications. A keyword search in PC MagNet for *Windows mouse cursors* will find you half a dozen DOS cursor enhancers. □

both to browse through your disk, and easily copy or move files between directories or disks.

XTreeGold has a similar capability, but you can't set the two-directory view as the start-up default, and, in general, you have to choose between loading the program quickly, or loading it to take advantage of all its features. That's acceptable if you plan to do all your work from XTreeGold, but not if you want to load and unload it as needed.

If you want to live in a DOS shell, XTreeGold has the edge, with a longer list of features than Norton Commander. But take a look at Norton Commander's $179 big brother, Norton Desktop for DOS. The program offers even more features than XTreeGold. Yet it needs more than 8MB for a full installation, making it hard to think of as a utility.

If you don't want a DOS shell, the solution is to use both programs. Norton Commander is a terrific, fast-loading utility for the features it offers—including, for example, a quick-and-dirty text editor. Hold XTreeGold in reserve for those features that only it offers. Combine the two programs, and without even trying real hard, you can get what you need.

Norton Commander, Version 3.0 *Symantec Corp., 10201 Torre Ave., Cupertino, CA 95014-2132; 800-441-7234, 408-252-3570; fax, 408-255-3344. List Price: $149.*
Circle 474 on reader service card

XTreeGold, Version 2.5 *XTree Co., 4115 Broad St., Bldg. 1, San Luis Obispo, CA 93401-7993; 800-388-3949, 805-541-0604; fax, 805-541-4762. List Price: $149.*
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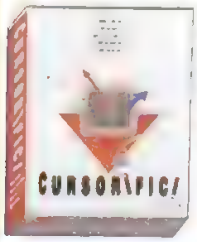
★Cursorific! Professional

Cursorific! Professional allows you to change and animate any standard Windows cursor, including the arrow, hourglass, I beam, cross-hair and window resize cursors. You can have different moving and stationary cursors; this makes your cursors easier to see when you move your mouse, but unobtrusive when you stop. Comes with 26 animated cursors and 300+ cursor images to choose from! Cursorific! Professional also comes with design tools to let you create your own cursors and animations. **Publisher: Alpex Software UT2953**



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Okidata Laser 400

In a comparison test against low-priced laser printers, *PC Magazine* awarded the Okidata Laser 400 its "Editors' Choice designation because of its phenomenal font range and because it provides " the best graphics and text quality." No other printer gives you more standard fonts and features for your money. 17 built-in fonts give you the look you want, "right out of the box." The hefty 200-sheet tray capacity keeps you going longer between refills. And an easy-to-read 16-character LCD message panel provides status messages and menu items. HP emulation supports all popular word processing and graphics software. With the Okidata Laser 400, you'll turn out page after (dppm) of dynamic, crisp-looking reports, letters, charts and spreadsheets. **Manufacturer: Okidata PR1020**

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MicroWarehouse 3-button Mouse

Compatible with all major application software, the MicroWarehouse 3-button Mouse is well-trained to provide dynamic resolution and fast tracking speed. Its opto-mechanical encoder ensures smooth, precision performance. With a price this low, there's no longer any reason not to take advantage of this nifty way to move more swiftly through your programs. **Manufacturer: MicroWarehouse IN2430**

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Stacker 2.0

Stacker 2.0, the award-winning data compression software from Stac Electronics, instantly and safely doubles the disk capacity of your DOS-based personal computer by compressing and decompressing your data without losing any information. Ideal for laptop and notebook computers, Stacker uses transparent, instantaneous compression to free valuable memory, letting you load additional programs and data. It's fully compatible with DOS and Windows programs and can even double the capacity of removable storage devices like floppy disks, Bernoulli disks and Syquest cartridges. **Publisher: Stac Electronics EX1484**

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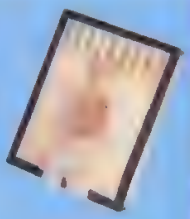
Bodyworks



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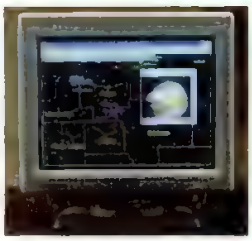
★The_Sky



Imagine the world's most powerful observatory captured on your personal computer. With The_Sky for Windows, the entire universe is yours to explore. With a click of the mouse, you can learn the constellations, display beautiful images of planets, galaxies, and nebula, print professional-quality star charts, and more! All this coupled with the power of Windows. For the most dazzling display of the heavens on your computer, The_Sky's the limit. **Publisher: Software Bisque ED3753/5**

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GR5143/5

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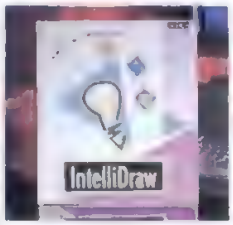

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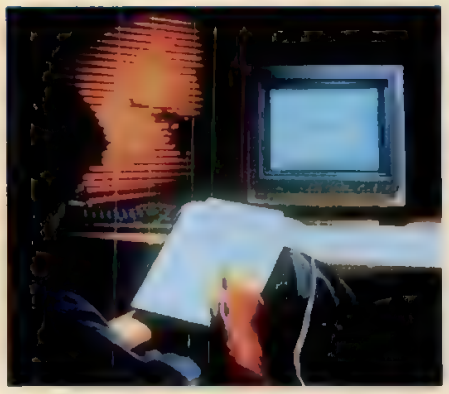

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can also do it selectively with utilities such as PKZIP and Shez that crunch files down to a fraction of their original size so you fit more on a floppy disk or transmit them cheaply over a modem.

PKWare Inc.

PKZIP

BY BRUCE BROWN

Space and time pose constant challenges for computer users. PKWare's PKZIP shrinks files to save disk storage space and speed file-transfer times. PKZIP works quickly, and because it uses only a few commands, it is easy to learn.

PKZIP uses separate compression and decompression modules. With a simple DOS-style command, you specify the file or files to compress and the name of the proprietary ZIP format file to save them in. The program displays the shrinkage achieved for each file during compression. While other vendors have come along with slightly better or faster compression schemes, PKZIP has become the industry standard.

PKZIP displays the percentage of compression achieved for each file.

PKUNZIP, the program's decompression module, restores files to their original sizes and names. During both compression and decompression, you can specify options such as password protection and attach a comment or message and a date criterion for selecting files. You can also save directory information to rebuild a directory structure when you decompress. A third module, PKSFX, creates self-extracting archives.

PKZIP is available as shareware via BBSs and shareware vendors. PKWare also sells the program directly for $25. Registered owners receive a printed manual (the shareware version is a DOS text file), greater access to user support, and a free copy of the next release. Site licenses are available.

PKZIP, Version 2.0, due out by the third quarter of 1992, will allow disk spanning; you'll be able to compress whole directories or disk drives with on-the-fly floppy disk formatting. Version 2.0 promises faster and tighter compression, lower memory requirements, and NetWare awareness.

When you transfer large files electronically between computers, whether by modem, direct cable connection, or disk, PKZIP can save plenty of time.

PKZIP, Version 1.1 *PKWare Inc., 9025 North Deerwood Dr., Brown Deer, WI 53223; 414-354-8699; fax, 414-354-8559. List Price: $25.*
Circle 476 on reader service card

California Software Design

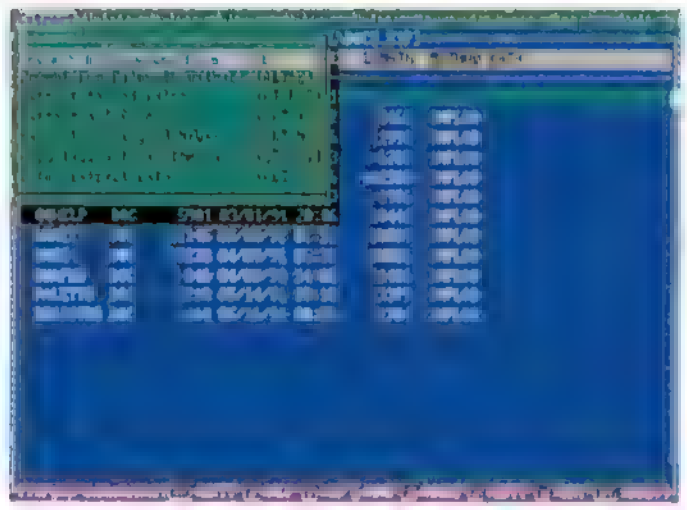
Shez

BY JOEL DREYFUSS

Archivers are great tools for crunching programs and files down to size, but their command line switches are numerous enough to make you nostalgic for Unix. Shez, by Jim Derr of California Software Design, is an easy-to-use front end that gives you menu and mouse access to some of the most powerful (and obscure) features of the major archiving programs. Shez, a shareware program available on bulletin boards, CompuServe, and ZiffNet, handles not just PKZIP, the most widely used archiver, but ARC, LHA, LZH, PKPAK, and other archiving programs. And, as a bonus, Shez will translate one type of zipped file to another and create self-expanding files in the most popular formats.

Shez uses pop-down menus to manage your archiving programs. You get a choice of editors and colors and several options for using RAM disks and memory. You can skip most of the advanced options and go right to work. You can always go back and alter your setup later.

Shez lets you open an archive and scroll through the files inside it. You can view the contents, and even edit them using your favorite text editor or viewer. The program is especially useful if you want to archive specific files from a crowded directory. You can select the files from a list, tag them, or create a wildcard option and let Shez do its magic. You can also pick one or more files from inside an archive, view them, and then unpack them to a directory of your choice. A single menu choice lets you turn a zip file into an .EXE file.



Shez's menus bypass the arcane command-line switches that archiving utilities favor.

Zipping and unzipping files has become a necessity in a world of crowded hard disks and modem transfers. Shez makes it a lot easier and lets you tap features in your archiving programs you may not even know about.

Shez, Version 7.2 *California Software Design, P.O. Box 15248, Santa Rosa, CA 95402; 707-575-9868. List Price: registration, $39; registration and most current version on-disk, $46.*
Circle 477 on reader service card

Stac Electronics

Stacker

BY M. DAVID STONE

Double your hard disk capacity, and you can save lots of money on the price of a new hard disk. This is the promise Stac Electronics makes for Stacker 2.0, a program that seems to offer something for nothing (well, for $149) and leaves any reasonable skeptic wondering if he or she is about to trade the family cow for a handful of magic beans.

This is one case where the magic works. Once Stacker is installed, it is essentially invisible. You use your hard disk as before, but you will find there is more room on it, thanks to Stacker's average compression ratio of 2 to 1.

In real-world tasks, the compression and decompression when loading or saving files won't slow you down noticeably. If top performance is an absolute require-

Paying again and again for virus protection is enough to make you ill.

Frankly, paying anything at all is pretty nauseating.

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Between them, these first two lines of defense can recognize and obliterate over 1000 of the little buggers — enough to protect you from 95% of the potential carnage.

Only Untouchable Network gives you centralized virus protection. Now you can install, monitor and control without having to leave your seat.

If you find that statistic reassuring, then you probably like the odds in Russian Roulette.

If you don't, you'll want to know that Untouchable is equipped with a unique *third* line of defense, which has been mathematically proven to be, well, untouchable.

Instead of looking for viruses, this third line of defense looks for *changes in your executable and system files.*

If the change is but a single byte, Untouchable will spot it and, using our patent-pending recovery technique, reconstruct the file to its original state.

The process is known as Generic Differential Detection, and certain other programs claim to perform it, too.

But only Untouchable calculates file signatures using not one, but two proprietary algorithms that can't be reverse-engineered.

Only Untouchable guarantees 100% safe recovery of infected files. (Unlike other programs that proudly generate corrupted files, Untouchable knows when the jig is up and doesn't attempt recovery.)

Only Untouchable can provide centralized network virus protection. In fact, Untouchable Network has enough virus alerts and reporting mechanisms to settle the stomach of even the most nervous Netware® administrator.

And only Untouchable is backed by our vaunted 24-hour toll-free technical support and a one-year money-back guarantee.

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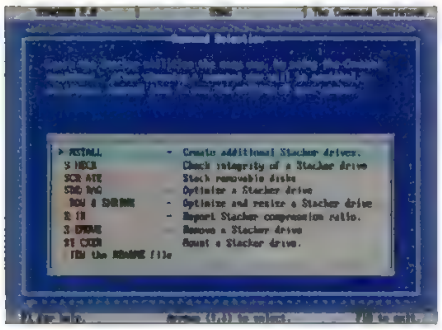
FIFTH GENERATION SYSTEMS, INC

CIRCLE 286 ON READER SERVICE CARD



Stacker's set of utilities installs and manages the compressed disk.

ment, you can get the hardware version, Stacker AT/16 ($249), or the MCA version, Stacker MC/16 ($299), which comes with a board that goes inside your computer. As is usual with coprocessed boards, however, the boost from hardware will be most helpful on slow systems.

If you have OS/2 as well as DOS on your disk, one drawback is that you can't read the Stacker disks when you're running OS/2. However, that's about to change: Stac recently announced an OS/2 version due out later this year.

Most important of all is Stacker's graceful response to disk problems. Stacker stores files in a single Stacker file, then tricks DOS into treating the file as a hard disk. And if your real hard disk develops a bad sector, you don't lose the whole Stacker disk. You lose only the file that the bad sector is part of, inside the Stacker file. With Stacker, you have nothing to lose and megabytes to gain. These magic beans work.

Zipping and unzipping files has become a necessity in a world of crowded hard disks and modem transfers.

Stacker, Version 2.0 *Stac Electronics, 5993 Avenida Encinas, Carlsbad, CA 92008; 619-431-7474; fax, 619-431-0880. List Price: $149.*
Circle 478 on reader service card

MEMORY MANAGERS

The Wall Crumbles

In 1981, IBM and Microsoft thought that 256K was a lot more memory than anyone could possibly use to run a program. When they cranked that up to 640K they ran into a wall of their own making. The memory beyond 640K was already allocated to other functions on the IBM PC. Software developers have been crashing against the wall ever since. The 386 and 486 chips had the ability to ignore the 640K limit, but the lack of an operating system that could directly access more memory spawned another cottage industry.

The memory managers on our list take good care of the most precious commodity on your PC. They fool DOS into thinking you have more memory than you really do. They give your applications the different kinds of memory they need: extended, expanded, or conventional. They move device drivers out of the way so your programs will have more room. By extending the memory available to DOS, they allow you to run programs that are bigger than 640K. And they free memory that you are no longer using when you quit an application. A PC with a 386 or higher CPU that does not have a decent memory manager is a V8 running on four cylinders. It gets you there, but you're missing all the fun.

Helix Software Co. Inc.
NetRoom

Quarterdeck Office Systems
QEMM-386

Qualitas Inc.
386MAX

BY RICK AYRE

The goal of memory managers used to be simple: to give you as much memory as possible in the 640K DOS box. Today, the best memory managers do that almost effortlessly. But life has gotten a lot more complicated.

You used to run just DOS. Now you may run MS-DOS, Windows, and DESQview, and maybe DR DOS and GeoWorks. You used to have just memory. Now you have lower DOS memory, expanded memory, and extended memory, not to mention the high memory area or upper memory blocks. And a lot of these flavors of memory have complicated specs.

A memory manager in the 1990s has to be smart enough to allocate the right kind and the right quantity of memory when your applications and environments ask for it. It also has to be easy to use. You want to run an installation program, then forget about it. Who has time to understand all this stuff, anyway?

Fortunately, there are several good memory managers. Helix Software has NetRoom, Quarterdeck Office Systems has QEMM-386, and Qualitas has 386MAX. All three have won *PC Magazine* Editors' Choice awards and come with helpful utilities.

They all do the basics well. They come with install programs that are easy to use, and will insulate you from the details, if that is your choice. Each approaches the task of memory management with a slightly different philosophy.

Quarterdeck believes that it can completely automate memory management for you. It does an admirable job. QEMM-386's basic install option consistently recovered the most lower DOS memory and chose the best overall configuration—without user input—of any of the programs we have tested.

386MAX takes a slightly less aggressive approach. Its goal is to avoid conflicts and incompatibilities. On occasion, during a QEMM-386 install, a PC would wander off into never-never land. That almost never happened with 386MAX.

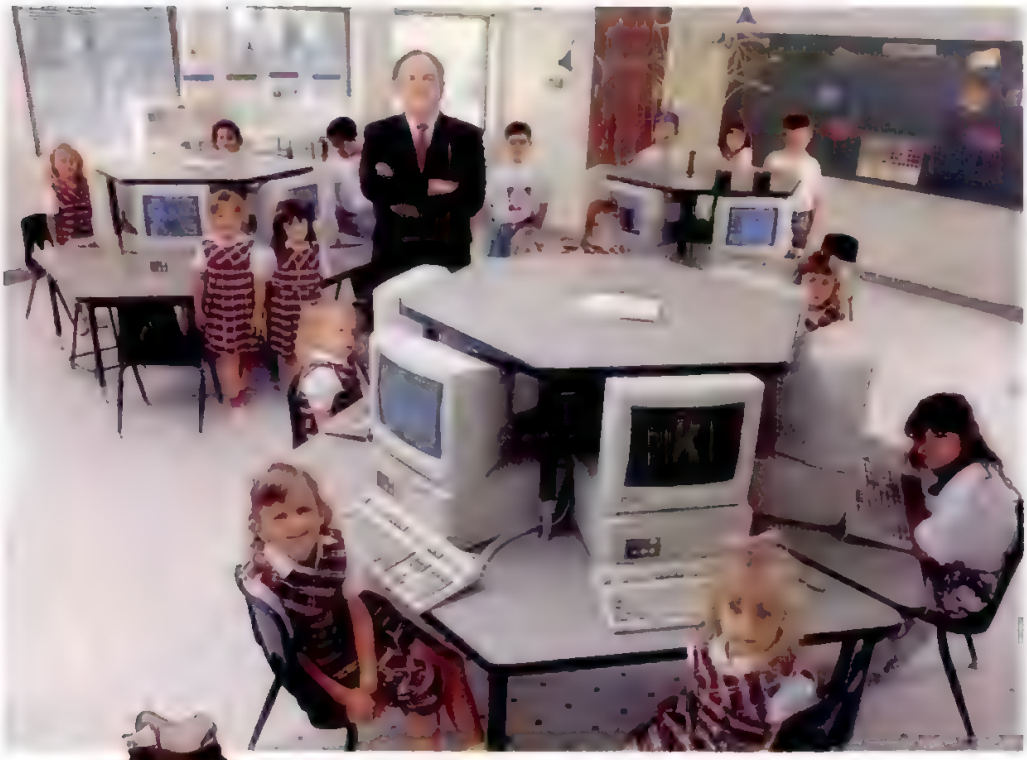
NetRoom is not just for networks, though it does work better with network drivers and TSRs than the other two memory managers. It is a general-purpose memory manager and does well what the other products do well. If you want to tweak your configuration, NetRoom, with its Discover utility, is the best choice.

All things considered, we don't think

Country Day School Expels NetWare

At the Country Day School in Arlington, Texas, students get individualized computer learning at an early age. Eighteen 386 PCs are networked to share encyclopedias on CD-ROM, a raft of reading, writing, math and science software in the classroom and Windows applications in the office.

The chairman says that if NetWare were a student, it would flunk reliability. "All we could predict is that we'd have problems. We bought the latest and greatest. NetWare 3.11 was difficult to use and required constant maintenance."



So they graduated to a LANtastic network with the help of Guy Dragoo at The Productive Edge, an Artisoft Authorized Five Star℠ dealer. "LANtastic does the job *better* than Novell, shares the CD-ROM with every station and can expand to 300 stations, all for 50% less," Mr. Fanning says. He gives the LANtastic network an A+.

The Country Day School board of trustees plans to add grades seven through twelve. "We're on a growth curve right now. The network has performed above and beyond our expectations. No matter how many nodes we add, our LANtastic network grows right with us," Chairman Fanning says. "We believe it's the best network out there."

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–James Fanning, Chairman of the Board

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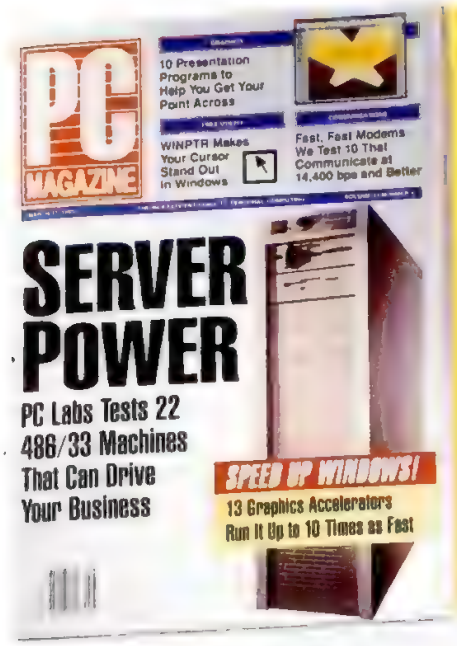

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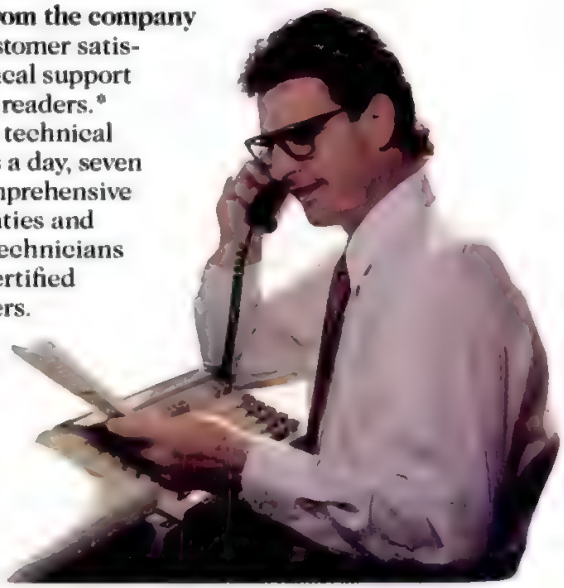

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CODE A4516

you'll go wrong picking from among these three packages. You may still experience problems when trying to optimize memory. Make sure you are using the current release of whatever program you choose, and be careful out there.

NetRoom, Version 2.2 *Helix Software Co. Inc., 47-09 30th St., Long Island City, NY 11101; 800-451-0551, 718-392-3100; fax, 718-392-4212. List Price: $99. Circle 479 on reader service card*

QEMM-386, Version 6.02 *Quarterdeck Office Systems, 1901 Main St., Santa Monica, CA 90405; 800-354-3222, 310-392-9851; fax, 800-354-3229. List Price: $99.95. Circle 480 on reader service card*

386MAX, Version 6.02 *Qualitas Inc., 7101 Wisconsin Ave., #1386, Bethesda, MD 20814; 800-676-0386, 301-907-6700; fax, 301-907-0905. List Price: $99.95 Circle 481 on reader service card.*

Quarterdeck believes that it can completely automate memory management for you.

TurboPower Software

TSR Utilities

BY RICK AYRE

The most common way to remove an unwanted TSR from memory is simply to reboot your computer. TSR Utilities provide a more elegant solution. These programs are a collection of command line utilities that manage TSRs. They do only one thing, but they do it very well. Using the programs in the TSR utilities package, you can load TSRs into memory, then unload them when you are done, reclaiming valuable memory.

It works like this: Load a version of their MARK program, then load your TSR; when you are done, run their RELEASE program and your system is as it was before you ran MARK. Simple and straightforward.

MARK uses about 1600 bytes of memory. There is a version that, by virtue of swapping to disk, takes up only 310 bytes. There is also a version designed specifically to work with large NetWare drivers. If you are using DOS 5.0 or another memory manager that provides access to upper memory (such as QEMM-386), you can use MARK/RELEASE to load and unload programs from that memory region as well as conventional memory.

The TSR Utilities are copyrighted by the developer, Kim Kokkonen of TurboPower Software, and cost you only the price of a download from the ZiffNet Tips Forum, or the TurboPower Libraries on CompuServe in the PCVENB Forum. They are also available on many other BBSs. Look for the file TSRCOM.ZIP.

TSR Utilities, Version 3.4 *TurboPower Software, P.O. Box 49009, Colorado Springs, CO 80949-9009; 719-260-6641; fax, 719-260-7151. List Price: Free. Circle 482 on reader service card*

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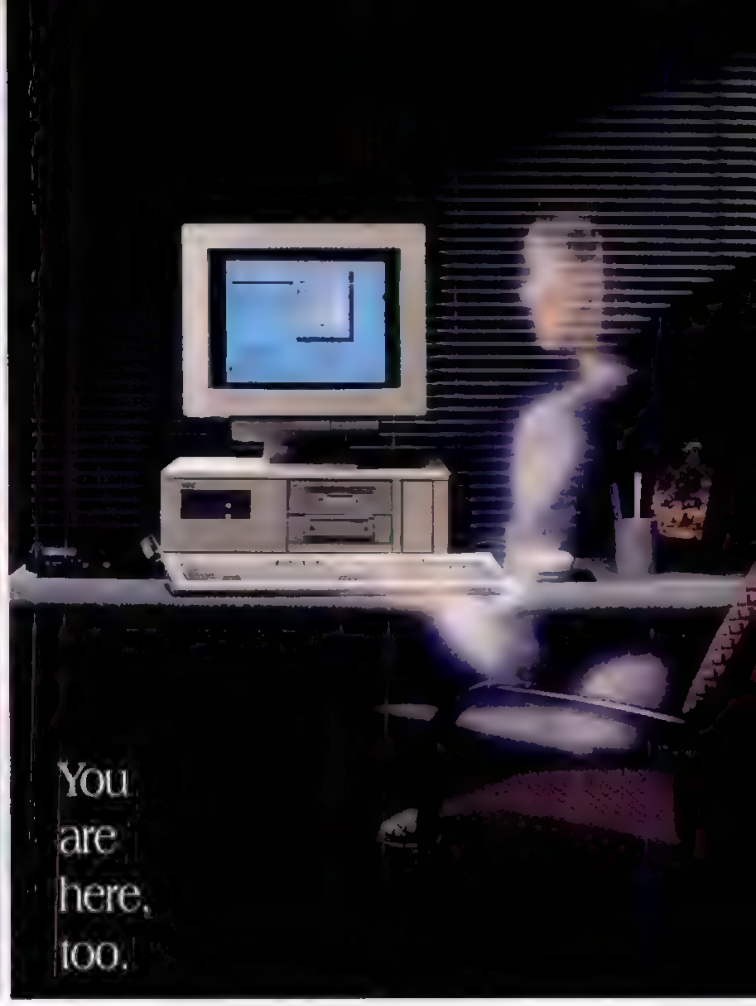

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GRAPHICS PROGRAMS

Gooey Gadgets

One of the biggest advances in Intel-based computing has been in graphics. What was once the domain of the Macintosh and lesser breeds such as the Amiga has gradually migrated to the Intel platform. More powerful microprocessors, higher video standards, the emergence of Microsoft Windows, and larger hard disks have made the PC a powerful graphics platform. Drawing programs such as CorelDRAW, presentation applications such as Lotus's Freelance Graphics and Symantec's Harvard Graphics, and even image editors such as Aldus PhotoStyler have become fixtures in the PC user's repertory.

A fundamental law of computing, however, seems to be that new functions spawn new challenges. The graphics utilities in this group help solve some common problems. Collage Plus and HiJaak let you grab an image on your screen and save it into a file. Paint Shop Pro converts graphics files among the multitude of file formats that have sprung up. NoBlink makes your cursor more visible—nothing to squint at here—and WinSpeed can give Windows a welcome charge when you're tired of watching pixels crawl across your monitor.

Screen-Capture Programs

Inner Media Inc.

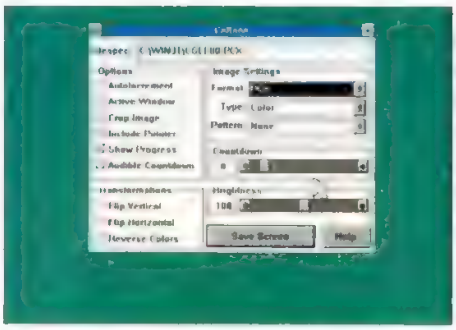
Collage Plus

BY BARRY SIMON

If you need to capture an image on your PC's screen, Inner Media's Collage Plus provides an all-in-one solution that gives you the most extensive screen-capture program on the market. In one $129 package, you get the capability to capture both DOS and Windows images.

The DOS version offers considerable flexibility. You can capture text or standard graphics modes in .PCX or TIFF format with choices as to color, black and white, or gray scale. You have the option to preview the image before you grab it and may choose one of two hotkeys to use.

If you load the capture program and previewer in conventional memory, they will take up a whopping 100K. But with EMS and no previewer, Collage Plus will take up as little as 10K. The memory problems and TSR conflicts that afflicted early versions of Collage for DOS have also been fixed.



Collage Plus's menus make a simple point-and-click affair of managing and converting graphics files.

Collage's Windows version features a countdown timer and has the same format flexibility as its DOS counterpart, with the added abilities to grab .BMP files and to capture to the Clipboard. You can choose whether to display the mouse pointer and you can even crop the image before saving it to disk. A DOS program that will quickly display and print .PCX and TIFF files and that can be used in a batch file to create a slide show is included.

Collage is your best bet if you need a screen grabber with limited conversion ability. Some programs, especially games, use unusual graphics modes and you may need to look elsewhere for screen capture. PCXDUMP is especially tuned to deal with such modes and with programs that take over the keyboard. The cost is $25 for shareware registration; a trial version is available as PCXDMP.ZIP in Library 16 (General Utils) of the Utilities/Tips Forum on PC MagNet. According to Inner Media, a Windows version is expected this fall.

Collage Plus, Version 3.2 *Inner Media Inc., 60 Plain Rd., Hollis, NH 03049; 603-465-3216; fax, 603-465-7195. List Price: $129.*
Circle 483 on reader service card

Inset Systems Inc.

HiJaak for DOS
HiJaak for Windows

BY BARRY SIMON

The Mercedes of image-conversion utilities is Inset Systems' HiJaak, which comes in DOS and Windows versions, each for $249. If you use Windows on a fast machine, you'll want the Windows version because of its smoother interface and extra features.

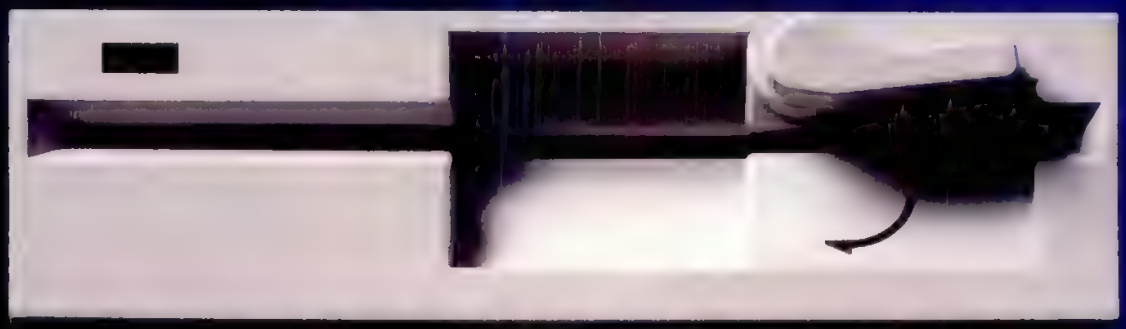
HiJaak is notable for its support of vector- and raster-based file formats. It allows not only the raster-to-raster conversions found in many other programs but also vector-to-vector and vector-to-raster. (Note that to convert from raster to vector, you'll need a tracing program such as the ones that are bundled with CorelDRAW or Adobe Streamline).

HiJack lets you handle a broad range of graphics files in a variety of formats, and you can view several files at once.

The Windows version also understands the different varieties of CGM, .PCX, and TIFF. During conversion, you can tell the program what the target application is and HiJaak will adjust the output accordingly.

Besides its basic conversion routines, HiJaak will perform a number of image-processing operations: resizing, converting to gray scale or black and white, smoothing, printing, and screen capturing. The DOS and Windows versions each

Drive.



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come with a capture module for the other environment, but each is stronger in its own environment. For example, the DOS capture in the DOS version gives you a number of choices of fonts used in the captured screen, but not the DOS capture in the Windows version.

The Windows version includes the ability to view files, but this feature can be painfully slow, even on a 386/25. With this caveat, HiJaak is a valuable tool for anyone who works with PC images.

HiJaak for DOS, Version 2.1; HiJaak for Windows, Version 1.0 *Inset Systems Inc., 71 Commerce Dr., Brookfield, CT 06804-3405; 800-374-6738, 203-740-2400; fax, 203-775-5634. List Price: $249 each. Circle 484 on reader service card*

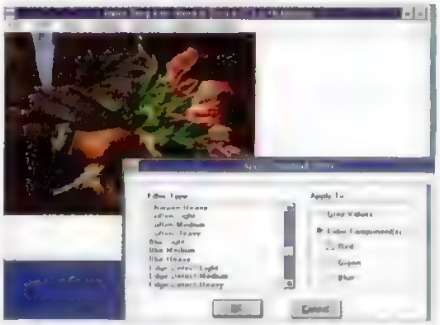
Graphics Converter

JASC Inc.

Paint Shop Pro

BY BARRY SIMON

JASC's $49 shareware program, Paint Shop Pro, is a bargain hunter's dream. It is a Microsoft Windows program that provides conversion and manipulation of bitmapped images and screen captures. It lacks some of the bells and whistles of other graphics-conversion utilities, but it covers all the basics, does them fast and well, and provides most of the services you'll find in programs costing three to five times as much. And as shareware, you can try it before you buy it: Paint Shop Pro is available as PSP.ZIP in Library 10



Paint Shop Pro manipulates bitmapped images and screen captures.

(Windows) of the Utilities/Tips Forum on PC MagNet.

It supports all the standard bitmap formats—.GIF, .PCX, TIFF—in up to 24-bit color, and also supports some less com-

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CIRCLE 029 ON READER SERVICE CARD

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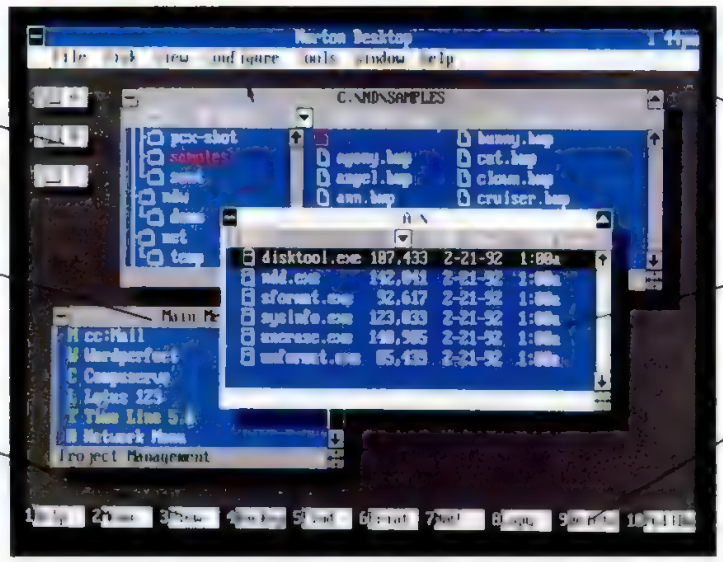

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mon ones, including .RLE. While it doesn't support JPEG, Paint Shop Pro has a proprietary lossy compression format similar to JPEG. By using Save As, the program acts as a conversion machine. One drawback is that you can't display multiple images.

In transforming your images, Paint Shop Pro will do just about anything you need it to. You can flip, resize, crop, sharpen, smooth, reduce colors, increase colors, convert to gray scale, gamma correct, and brighten and change contrast. Its list of filters is a little meager compared with high-end products, but it is a lot cheaper.

Paint Shop Pro is not actually a paint product, since it doesn't allow editing at the bit level. Its competitors are Computer Associates International's CA-Criquet Image and Computer Presentation's ImagePrep. If you are a professional artist or DTP maven, you'll want the higher-end products. But if your needs are simple—to stretch Windows wallpaper or for straightforward file conversion—you'll find Paint Shop Pro an excellent choice.

Paint Shop Pro, Version 1.01 *JASC Inc., 17743 Evener Way, Eden Prairie, MN 55346; 612-934-7117 (voice and fax). List Price: $49 (shareware).*
Circle 485 on reader service card

Eye Saver

Instant Replay Corp.

NoBlink

BY EDWARD MENDELSON

NoBlink does what its name says. Instant Replay Corp.'s $49.95 utility transforms the blinking DOS cursor into an unblinking block. By doing so, it transforms your monitor from a continuous source of subliminal irritation to a soothing island of visual calm. Because it also speeds cursor movement, it can reduce your impatience while increasing your efficiency.

Once you experience NoBlink, you'll be amazed to realize how annoying a blinking cursor can be. If you worry that a steady-state cursor may be hard to locate on-screen, NoBlink lets you set the cursor to any attention-getting color of your choosing.

NoBlink occupies 6KB of RAM and loads in high memory. It's miles ahead of all other cursor-control utilities, although it doesn't work perfectly with all software. In a few programs that use dialog-box menus, it leaves a block cursor in the middle of the screen, and in some combinations of software and video hardware, it leaves cursor trails behind it as you type. You can avoid both problems by switching to a blinking cursor with a hotkey or from the DOS command line. The latest version lets you set cursor color from the command line in addition to the hotkey control in earlier versions, so you can now write batch files that set different cursor colors for different applications.

NoBlink lets you work longer and more comfortably than you can without it. After a while, you may forget it's on your system—until you suffer the discomfort of working on a system without it.

NoBlink, Version 5.3 *Instant Replay Corp., P.O. Box 9252, Salt Lake City, UT 84109; 800-388-8086, 801-272-0671; fax, 801-272-0675. List Price: $49.95.*
Circle 486 on reader service card

Video Utilities

Sonera Technologies

DisplayMate Video Display Utilities

BY MARY KATHLEEN FLYNN

The quality of monitors varies dramatically from unit to unit, but most PC users can't afford fancy test equipment like the Microvision Superspot 100 used at PC Magazine Labs to weed out the bad from the good. Luckily, there's Sonera Technologies' DisplayMate, a $149 set of video display utilities that runs diagnostic tests on your monitor and display. It helps you determine whether or not you've brought home a lemon. Best of all, DisplayMate will tell you how to correct many common problems yourself and which ones will require the services of a repair technician.

Despite its technical complexity, DisplayMate is quite easy to use, largely because of its thorough documentation. The manual is more accurately a book on display technology; the program is menu-based with help built-in just about everywhere.

The program is divided into two tracks, technical and nontechnical. The technical

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track requires the user to take complex measurements and is probably most useful for quality-assurance professionals. The nontechnical track is well suited to individual PC users, who will learn much about judging image quality and optimizing their displays. Most of the program is devoted to analyzing test patterns as well as some performance results.

The most troubling limitation of DisplayMate today is that the highest resolution it works with is VGA. An upcoming product, DisplayMate Professional (which will cost $249 for new users and $99 for current DisplayMate users), will add some Super VGA-specific tests (all VESA-compatible modes through 1,280-by-1,024), improved report generation, and test scripts for professionals.

The best thing PC users can do for their eyes is to buy the right 16-inch, noninterlaced Super VGA monitor with a high refresh rate—VESA recommends 72 Hz at 800-by-600 resolution—and then fine-tune it with DisplayMate.

DisplayMate Video Display Utilities *Sonera Technologies, P.O. Box 565, Rumson, NJ 07760; 800-932-6323, 908-747-6886; fax, 908-747-4523. List Price: $149.*
Circle 487 on reader service card

Panacea Inc.

WinSpeed

BY MARY KATHLEEN FLYNN

Before you rush out to buy the latest video hardware, you may want to try Panacea's software solution. At a list price of $79 (and a street price of around $55), WinSpeed could improve the performance of your current video board significantly. And if it doesn't, you can always get your money back.

WinSpeed is a set of drivers that have been optimized for Windows' 256-color modes. (It won't do anything for DOS or Windows' 16-color modes.) The latest version, 1.03, solves some installation snags a previous version had with Windows 3.1. Installation is quick and easy—although you must have Windows already on your hard disk, and you'll need a full set of Windows disks. Once installed, WinSpeed is transparent.

The Norton Utilities is a lifesaver—and filesaver. It brings files back from the dead. It even resuscitates hard disks that have stopped breathing.

The only thing that is wrong with WinSpeed is that it doesn't work with every video board and it doesn't necessarily speed up every board it works with. According to Panacea, it will improve the performance of boards based on the following chip sets: ATI, Tseng Labs ET-4000, Trident 8800 and 8900, Video Seven, and Western Digital/Paradise. (An upcoming version will support Oak and Ahead chip sets). On informal tests, we found that on an ET-4000-based board, such as the Orchid ProDesigner IIs, WinSpeed offers significant speed gains. The IIs performed 30 percent faster with WinSpeed than it did with its standard driver on *PC Magazine*'s graphics test. But with ATI's boards, we recommend getting the latest drivers direct from ATI, which has put a lot of effort into improving the quality of its drivers. The ATI VGA Wonder XL actually performed slightly slower with WinSpeed than it did with ATI's April 1992 Win 3.0 driver or with the company's latest Win 3.1 driver.

To make sure your system is actually improved by WinSpeed, Panacea recommends using perceptual tests, like the fish tank on screen savers such as After Dark. You may also want to run more sophisticated tests, such as our Graphics Winmark tests. If the package doesn't work with your particular board (or monitor), or doesn't improve its performance, WinSpeed is easy to uninstall, and Panacea offers a 30-day money-back guarantee (all you need to do is contact the retailer within 30 days of purchase).

WinSpeed, Version 1.03 *Panacea Inc., Post Office Square, 24 Orchard View Dr., Londonderry, NH 03053-3376; 800-729-7420, 603-437-5022; fax, 603-434-2461. List Price: $79.*
Circle 488 on reader service card

LIFESAVERS

A Grab Bag of Tricks

We simply ran out of categories to cover some of our favorite utilities. The Norton Utilities is a lifesaver—and filesaver. It brings files back from the dead. It even resuscitates entire hard disks. AutoCon cleverly manages the multiple setups that have become a way of life for so many computer users as they try to handle network drivers, GUIs, and myriad TSRs. PrintCache will free your computer from having to wait to finish printing before you can use it again.

Larry Weaver

AutoCon

BY SAL RICCIARDI

Managing your AUTOEXEC.BAT and CONFIG.SYS files these days can drive you crazy. I have about 30 boot file combinations customized for different purposes. For example, there's one for loading NetWare high, one for loading NetWare low, one for loading parts of NetWare high and parts of NetWare low—an entire suite of boot setups designed to help me get around DOS's limitations. With

AutoCon makes it easy to maintain a database of boot file combinations.

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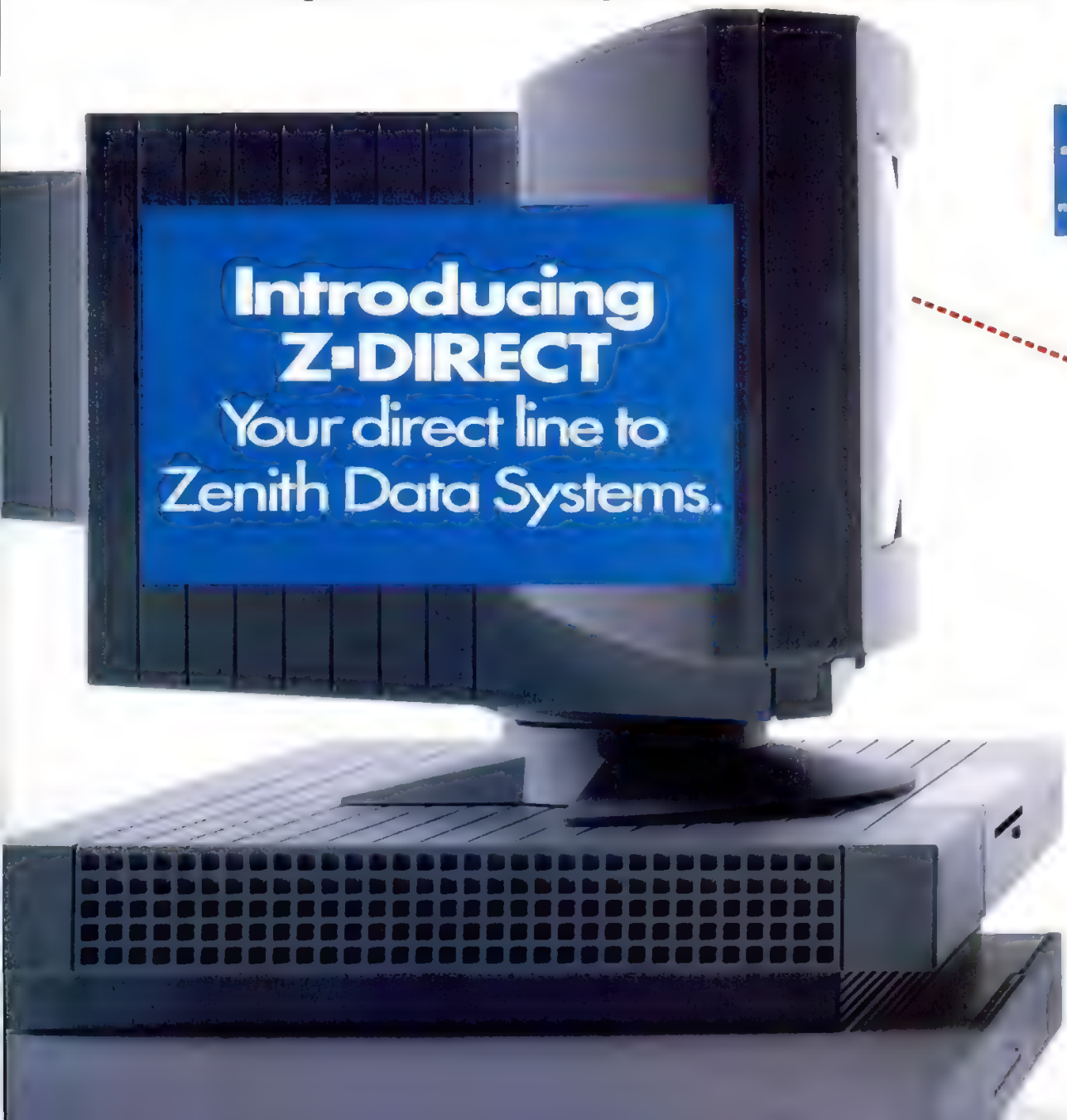

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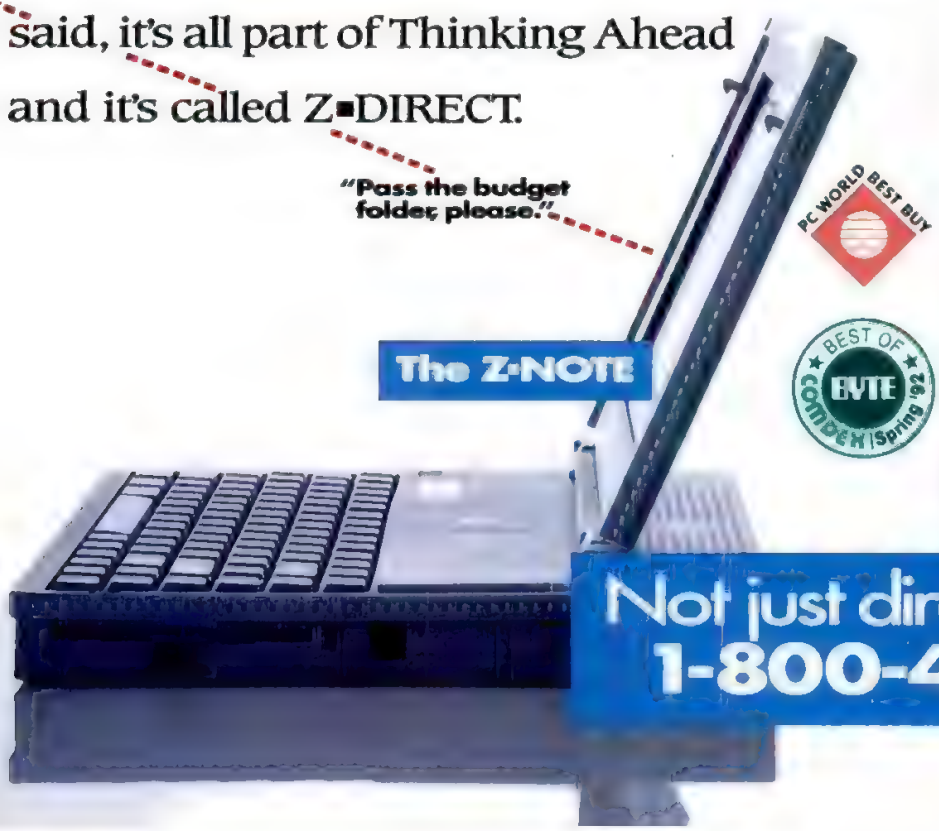

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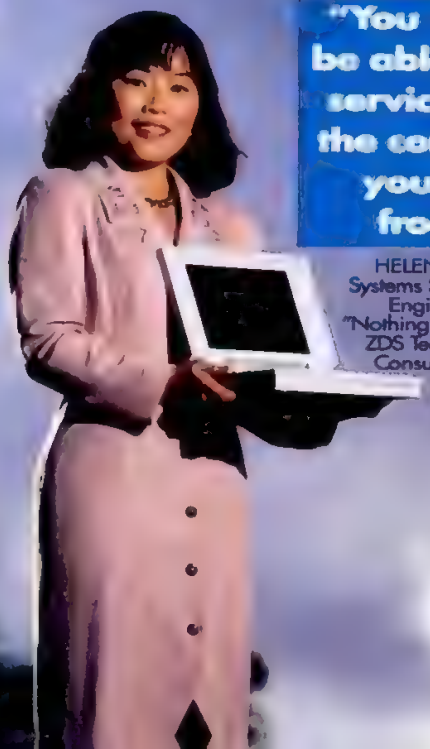

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Thinking Ahead.

AutoCon, shareware author Larry Weaver has created a nearly perfect answer to the problem of maintaining multiple boot file configurations.

AutoCon lets you maintain up to 50 AUTOEXEC.BAT and CONFIG.SYS file combinations. Unlike other boot managers, it doesn't force you to keep a single long AUTOEXEC.BAT or CONFIG.SYS file with embedded sections for each boot setup. Instead, it uses a database metaphor, storing each combination in a record in your AUTOCON.DAT file. This means when you reboot, you end up with an AUTOEXEC.BAT and CONFIG.SYS file customized for that session, instead of two files cluttered with a lot of other things.

You can page through the database and edit each record's AUTOEXEC .BAT or CONFIG.SYS using a built-in WordStar-like editor with block functions. You can customize the editor's keystrokes. You can give each record a name, such as WIN31 for Microsoft Windows, so that you can later reboot using AUTOCON WIN31. If you use a disk cache, you can tell AutoCon to flush your cache prior to rebooting. You can also have AutoCon display a menu of boot choices every time you reboot. Alternatives to AutoCon include *PC Magazine*'s own CONFIG.CTL; BOOT.SYS (First Looks, July 1990), another shareware offering; and BootCon (First Looks, May 26, 1992).

All things considered, AutoCon is a solution that is easy to use and understand. And at $23, it's a considerable bargain.

AutoCon, Version 2.0g *Larry Weaver, P.O. Box 2639, Weaverville, CA 96093-2639; 916-623-5045. List Price: Shareware available on Library 8 (ASP Applications) of the Utilities/Tips Forum on PCMagNet and on BBSs, including the AutoCon Support BBS (916-623-4455). Registration only, $15; registration and disk, $23; site license and disk for 100 users, $128; additional 100 users, $100.*
Circle 489 on reader service card

Symantec Corp.

The Norton Utilities

BY SAL RICCIARDI

You only have to be saved once to fall in love with The Norton Utilities. The granddaddy of DOS disk utilities has become much more than your garden variety file-recovery program, but it is still the ability to recall those slip-of-the-finger lost files that will endear you to this product forever. Symantec's latest version goes well beyond file recovery, letting you quickly and easily diagnose and repair all the disk errors you're ever likely to encounter.

Accidently deleted a file? The Norton Utilities' UNERASE function will save you.

First and foremost, there's UNERASE, which recovers files faster and more easily than any other product currently on the market. Then there's the Norton Disk Doctor, which diagnoses, reports, and repairs all kinds of disk errors swiftly and elegantly, and the Norton Disk Editor, which lets you view and edit the most sensitive and secret parts of your disks and files. If you have files you want to erase permanently, there's WIPEINFO, which makes your files completely unrecoverable. And the Norton Speedisk program safely and speedily defragments your hard disk drives.

If you can spare 2MB of disk space for a PrintCache spool file, you'll probably never again wait for your printer.

Also included are a variety of other utilities that warehouse deleted files, encrypt files on the fly, prevent access to a disk, repair damaged database and spreadsheet files, test and optimize the disk interleave, enhance batch files, set your cursor size, and more. A replacement for COMMAND.COM based on the shareware 4DOS is also included. Simply put, The Norton Utilities are both essential and indispensable.

The Norton Utilities, Version 6.01 *Symantec Corp., 10201 Torre Ave., Cupertino, CA 95014-2132; 800-441-7234, 408-252-3570; fax, 408-255-3344. List Price: $179.*
Circle 490 on reader service card

LaserTools Corp.

PrintCache

BY JIM SEYMOUR

Many of the best DOS utilities make you choose between DOS and Microsoft Windows—or at best, run only as DOS apps under Windows. PrintCache, which is simply the best print spooler ever written, is a happy exception: It works as a DOS-only app, or reconfigures itself to the requirements of Windows, where it replaces Print Manager and puts the Redmond coders to shame.

Spoolers are normally dull, invisible workhorses. So is PrintCache. But its performance and versatility set it apart from the pack. You can spool to RAM or to disk, and you can set the size of that block of memory or hard disk real estate set aside for spooling. (Hint: spooling to disk is almost imperceptibly slower and preserves RAM.) Pop-up boxes under DOS or Windows let you stop and restart printing, cancel a job, or check your settings. (However, there's no resequencing of a queue of spooled documents.) PrintCache also has a tidy graphics-compression routine that lets you squeeze full-page graphics out of even old, low-memory LaserJets.

If you can spare 2MB of disk space for a PrintCache spool file, you'll probably never again wait for your printer. The program is smart, efficient, and bulletproof: It seems to get along with everything. This kind of program is, you may remember, why you like DOS utilities so much. □

PrintCache, Version 3.0 *LaserTools Corp., 1250 45th St., #100, Emeryville, CA 94608; 800-767-8004, 510-420-8777; fax, 510-420-1150. List Price: $149.*
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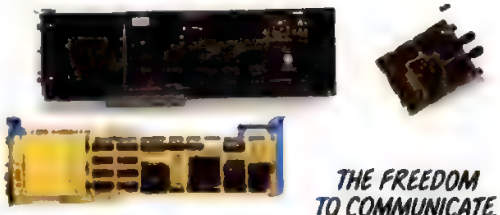

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TOKEN-RING:

Poised for an Explosion

Imagine. You've got dozens of PCs that need to be connected. PCs that need access to the company's IBM AS/400 and 3090. PCs that need to swap information with a local file server. What are you going to do?

Many companies with similar concerns have solved them by wiring their PCs into a 16/4-megabit-per-second (Mbps) Token-Ring network, the LAN touted by IBM. Introduced in the mid-1980s, Token-Ring has become the most

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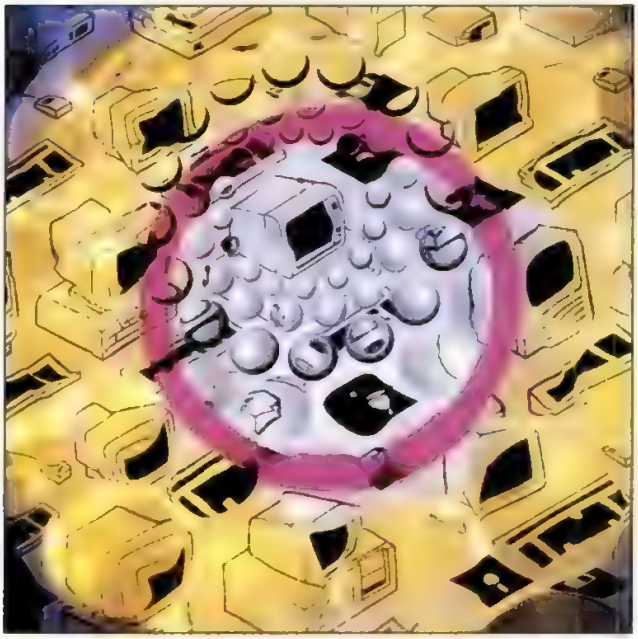

New chip sets and expanding options are shaking up the Token-Ring marketplace. We test 18 adapters to help you sort out the best choices.

by Frank J. Derfler, Jr. and David Greenfield

Photo illustration by Arthur Tress

popular way to connect local IBM computers. IBM has parlayed this popularity into dominance of adapter sales as well: According to InfoCorp, IBM is responsible for 77 percent of the Token-Ring adapter cards sold worldwide.

But what was once almost purely an IBM market is now poised for an explosion of competition—and competitive pricing. New Token-Ring chip sets from Advanced Micro Devices, Chips & Technologies, National Semiconductor Corp., Texas Instruments, and Western Digital Corp. are all expected to drop the cost of Token-Ring adapters by as much as $300.

With so many new and emerging options, the smart shopper can now get the benefits of Token-Ring networking—performance, reliability, and most important, IBM compatibility—without paying for the IBM name.

Finding the right adapter isn't easy, though. It requires a thorough understanding of your own needs as well as the capabilities of the adapter you are considering. Our tests are designed to reveal the strengths and limitations of the 18 currently available 16- or 32-bit adapters for ISA (Industry Standard Architecture), EISA (Enhanced Industry Standard Architecture), and MCA (Micro Channel architecture) buses.

See the Editors' Choice box for our picks: the Anco T2002 for the ISA bus; the Smart 16/4 EISA Ringnode, from Madge Networks, for the EISA bus; and the Thomas-Conrad TC4046 for the MCA bus. We also give honorable mention to three ISA adapters, the Olicom 16/4 ISA Adapter, the Smart 16/4 AT Ringnode, and the Thomas-Conrad TC4045, and three MCA adapters, the DCA IRMAtrac Token-Ring Adapter/Convertible, the Smart 16/4 MC Ringnode, and the Olicom 16/4 MCA Adapter.

These adapters and their competitors were tested under NetWare 3.11. We evaluated each one's throughput, impact on PC performance, robustness, ease of installation, and price.

HIGHLIGHTS

16-Mbps Token-Ring Adapters

EIGHTEEN TOKEN-RING internal adapter cards from ten vendors are reviewed here, all of them 16- and 32-bit adapters switchable between 16 and 4 megabits per second. All were evaluated for their suitability as server or client adapters.

DOUBLE THE BUS INTERFACE and you double the throughput. At least that's what we found in our initial evaluation of 8-bit versus 16-bit Token-Ring adapters. If you're going to buy a network adapter for a desktop computer, you'll want the speed of a 16-bit adapter.

STEEP PRICE DROPS in Token-Ring adapters are expected to follow the introduction of new chip sets from at least five different vendors.

THE IDEAL SERVER ADAPTER must not only be fast, it must conserve CPU overhead. Low CPU utilization allows you to add multiple adapters to the server so you can divide network traffic and get even better throughput.

THE IDEAL CLIENT ADAPTER not only has high throughput, it has a low price. Low CPU utilization is a plus but is not nearly as important as it is with a file server.

TOP PERFORMANCE in a Token-Ring adapter comes from an efficiently coded software driver and from superior techniques for transferring data from the computer's bus to the adapter. One of these techniques, bus mastering, temporarily transfers control of the expansion bus from a system's microprocessor to the adapter, freeing up the PC's CPU to handle other tasks.

IBM DOMINATES THE TOKEN-RING market, but its network adapters are far from the fastest. If you want the security of an industry standard, then go with IBM. If you want speed, look at the other products reviewed here.

LOW-PRICED, EFFICIENT adapters such as the Anco T2002 offer good value for installations of large numbers of client PCs. The T2002 is the least expensive adapter we tested, and one of the best performers.

THE FASTEST ADAPTERS for the ISA bus are from Anco Technology Corp., Madge Networks, Olicom USA, and Thomas-Conrad Corp. For the Micro Channel bus, Thomas-Conrad's and Olicom's adapters lead the way. For the EISA bus, the swiftest adapter comes from Madge.

DUAL-PROTOCOL CHIPS are on the horizon, with the ability to run both Token-Ring and Ethernet from the PC's motherboard. The first vendor to ship a multiprotocol chip was Texas Instruments, with its Super Eagle. Compaq is expected to release a server based on the Super Eagle sometime this November.

VARIATIONS ON AN ADAPTER

Although all adapters can fit into a file server or client PC's slots, we found that certain characteristics often cause one adapter to be better suited to a particular need.

Client adapters are typically on the lower end of the price range. And while they may offer great performance, it's usually at the expense of CPU utilization. Eight-bit adapters, for example, are less expensive than 16- or 32-bit adapters, but informal testing reveals that they offer significantly less throughput and higher CPU utilization. For this reason, we recommend using a 16-bit adapter in a client 386 system.

Server adapters also offer great performance, but their effect on the CPU is also worth considering. One way to increase the performance of the file server is to feed it more data by adding a second or third network adapter to the server. Some adapters, however, like Olicom's EISA card, can hog as much as 70 percent of a PC's processing capabilities. Despite its high throughput, Olicom's adapter isn't the best choice for an EISA server.

We found a few other interesting

twists as well. Several vendors simplify installation by using software to configure an ISA adapter. EISA and MCA adapters ship with an Adapter Description File (ADF) containing the necessary settings for the configuration program that comes with the EISA or MCA machine. Four vendors—Digital Communications Associates (DCA), IBM Corp., Lantana Technology, and Madge Networks—provide ISA adapters that are completely software-configurable, while six of the vendors of ISA products—Accton Technology Corp., Anco Electronics, CNet Technology, Olicom USA, Proteon Technology Corp., and Thomas-Conrad Corp.—require you to set some switches. If you're a novice, look for software installation, but expect to pay a little bit more.

Flexibility is important, since you may want to expand or change your network sometime in the future. You may be able to avoid purchasing a new adapter if the one you're using works with a variety of network operating systems and on various types of cabling. All of the adapters that we review support NDIS (Network Driver Interface Specification). With NDIS, the adapters can run under Microsoft LAN Manager in its various flavors in server and client PCs and with Banyan's VINES on client PCs. And all the adapters support the popular shielded twisted-pair (STP) cabling. With the exception of the IBM Token-Ring Network 16/4 Adapter/A, the devices also offer support for UTP. The Token-Ring Network 16/4 Adapter/A can support UTP once you add a $50 media filter.

If you're concerned about your adapter breaking down, relax. Long-term warranties are standard. Most vendors back up their adapters for three to five years. Accton, Lantana, and Proteon provide lifetime warranties.

EDITORS' CHOICE

- **Anco T2002 (ISA)**
- **Smart 16/4 EISA Ringnode (EISA)**
- **Thomas-Conrad TC4046 (MCA)**

The ideal adapter card for a network server is reliable and blazingly fast. It uses minimal CPU cycles, and it comes backed by a strong, high-quality company. The best choice for an EISA card is Madge Networks' Smart 16/4 EISA Ringnode.

It showed the highest throughput of any adapter we tested, regardless of bus type. If the Ringnode has a drawback, it's the $1,295 price tag. The slower Proteon ProNET-4/16 P1990 costs $300 less.

If the perfect server adapter must be fast, the perfect client adapter must be fast and inexpensive. This is why we are not giving Editors' Choice to the IBM Token-Ring Network 16/4 Adapter/A, despite IBM's strong presence in the Token-Ring market. The $895 adapter is no less expensive than several better-performing MCA adapters.

The Thomas-Conrad TC4046 is our Editors' Choice in the MCA arena for its balance of high throughput and low CPU utilization. The $750 adapter achieved the highest Performance Index among MCA adapters in three out of four instances.

The runner-up in the MCA category, the DCA IRMAtrac Token-Ring Adapter/Convertible, offered low CPU utilization and a flexible design that also allows it to work in ISA and EISA machines, earning it an honorable mention.

The DCA card has the same price as the Olicom 16/4 MCA Adapter ($895), but costs less than Madge's Smart 16/4 MC Ringnode ($945). Despite their relatively high pricing, the Madge and Olicom MCA adapters are still solid buys. They offer fine performance, and with strong companies behind them, they deserve honorable mentions as well.

The Anco T2002 and Thomas-Conrad TC4045 were by far the best picks among ISA cards; they both performed well on our tests. But the Anco's $495 price—the lowest of any adapter reviewed here—makes it the runaway Editors' Choice, with a strong honorable mention going to the TC4045, which costs $795.

Madge and Olicom also earn honorable mentions for their ISA adapters (the Smart 16/4 AT Ringnode and Olicom 16/4 ISA Adapter, respectively). These products displayed excellent throughput. Their CPU utilization was very high, however, and so was their pricing: The Madge product costs $945, and the Olicom runs $895. These ISA cards are more appropriate for client adapters, since client stations typically contain only one network adapter using up CPU cycles.

PERFORMANCE DIFFERENCES

With the exception of IBM, which makes its own chip set, all of the vendors depend on Texas Instruments for their Token-Ring controllers. Still, there are significant differences in performance, depending on the efficiency of the driver and how the data is moved between the PC and the adapter.

The Token-Ring adapters in this review each move data to and from the PC in at least one of three ways. Some use I/O channels. Other adapters create a region in memory and move the data in and out of it; this technique is called *shared memory*.

Both techniques require the intervention of the PC's processor. A third approach, bus mastering, does not require much help from the host processor. A bus-mastering adapter has its own onboard processor that moves data to and from the PC's RAM without interrupting the PC's processor (see the sidebar "Mastering the Bus").

The quality of the driver can have a huge impact on adapter performance. The driver initially sent by Accton, for example, slowed its adapter down significantly. A newer ODI (Open Data-link

Interface) driver the company sent later vastly improved the performance of the adapter. On the other hand, the high performance and low CPU utilization of Madge's Smart 16/4 EISA Ringnode adapter can largely be attributed to its driver.

One distinctive aspect of all of the adapters from Madge is their ability to improve peformance by running network protocols, such as Novell's IPX (Internet Packet Exchange), on the TI Token-Ring chip set itself, rather than completely through the software. Madge licenses source code from Novell and customizes the code for the TI processor.

TEST RESULTS

Among EISA adapters, Madge's Smart 16/4 EISA Ringnode had the highest throughput. Our CPU Utilization tests showed that the devices from Proteon and Madge had the least impact on the server. Because of its lack of bus mastering, Olicom's adapter used more than 70 percent of the server's processing capabilities on the first 4K-packet test. None of the three EISA adapters had any problem with the Cable Lobe Length tests, in which we varied the cable length between the server and the Multistation Access Unit (MAU) from 412 to 462 to 512 feet. Each adapter worked at all three test lengths.

Among ISA devices, the products from Madge, Olicom, and Thomas-Conrad showed the highest throughput, with the Lantana device and the Accton adapter under its IPX driver offering the poorest performances. The Anco and Thomas-Conrad adapters achieved the best scores in the Performance Index, which shows the ratio of network utilization to CPU utilization. All the adapters passed the Cable Lobe Length test at 412 feet. All the devices but the CNet CN1000T passed at 462 feet; the Anco, DCA, Lantana, Madge, Olicom, Proteon,and Thomas-Conrad devices passed the test at 512 feet.

The MCA adapters were the most difficult to test. Unlike EISA or ISA, MCA uses an arbitration scheme for installed cards. The cards having the highest arbitration level get the least priority in service. We tested the adapters at their default priority levels and then raised their priority; these experiments almost always increased throughput. All the results on our charts are for the default priorities.

The Thomas-Conrad TC4046 and the Olicom 16/4 MCA Adapter had the best throughput of any of the MCA adapters. All MCA adapters passed the Cable Lobe Length tests at 412 and 462 feet. Only Madge's Smart 16/4 MC Ringnode did not work at 512 feet.

Significant performance differences result from the efficiency of the driver and how data is moved between the PC and the adapter.

REVIEW CRITERIA

To be included in this roundup, the 16-megabit-per-second Token-Ring adapters had to support NDIS and ODI drivers and have at least a 16-bit interface; the adapter vendor also had to be the OEM (original equipment manufacturer).

NDIS and ODI are two of the leading device driver specifications. Introduced by Microsoft, NDIS has since been adopted by many other vendors. ODI is championed largely by Novell. Both NDIS and ODI enable you to run multiple network protocols simultaneously. By providing vendors with standards for drivers, these specs let vendors concentrate on enhancing their drivers to work with a variety of network environments.

Most of the vendors whose products are reviewed here also offer 8-bit adapters. At an average list price of $500, 8-bit adapters are significantly less expensive than 16-bit adapters. But that price drop does not come without some restrictions in performance, as noted earlier. For many users, those restrictions may not be a concern—particularly users with older, less powerful computers and minimal networking requirements. But if you are connecting a 386 or better computer to a network, it's probably wise to invest in the more powerful 16-bit adapter so you can expand your network to meet future needs.

A number of vendors, such as Optical Data Systems and Ungermann-Bass, license adapters from Olicom. Madge has also sold its Token-Ring software to a number of vendors. Typically, such vendors don't alter the hardware or software and consequently their products aren't included in the review.

We also didn't look at external Token-Ring adapters, such as those sold by Accton and Xircom. External Token-Ring adapters typically attach to the parallel port of the PC and tend to be slower than internal adapters. If you're looking for a laptop connection, external Token-Ring adapters are great, but they're not the best choice for desktop PCs. (For more information on these devices, see "External Token-Ring Adapters: Plug and Play—and Pay?" *PC Magazine,* January 14, 1992).

MAKING THE CHOICE

When deciding among Token-Ring adapters, you'll need to evaluate their reliability, compatibility, CPU utilization, network throughput, and of course, price. A long-term warranty is a good indication that the vendor is confident of its adapter's reliability; all of the adapters we review have such warranties. But beyond comparing warranties, what other indicators of reliability should you be looking for?

One important aspect of an adapter's reliability is its ability to distinguish a received signal from electrical noise over a long length of wire. Token-Ring installations have recommended maximum distances for placing a station or server away from a hub. The maximum recommended distance for the unshielded twisted-pair cabling (what IBM calls Type 3 cable) and the Cabletron Concentrator TRMIM-22 hub used in our installation is 197 feet. We tested our Token-Ring LAN adapters over cable lengths of up to 512 feet. At that distance, only

Our Contributors: FRANK J. DERFLER, JR. is senior networking editor of *PC Magazine*. DAVID GREENFIELD is associate editor of the networking and communications team. WINN L. ROSCH is a contributing editor to *PC Magazine*. STEVE RIGNEY and M. KEITH THOMPSON are frequent contributors to *PC Magazine*. PADRAIC R. BOYLE is senior networks analyst for Ziff-Davis Publishing Co.

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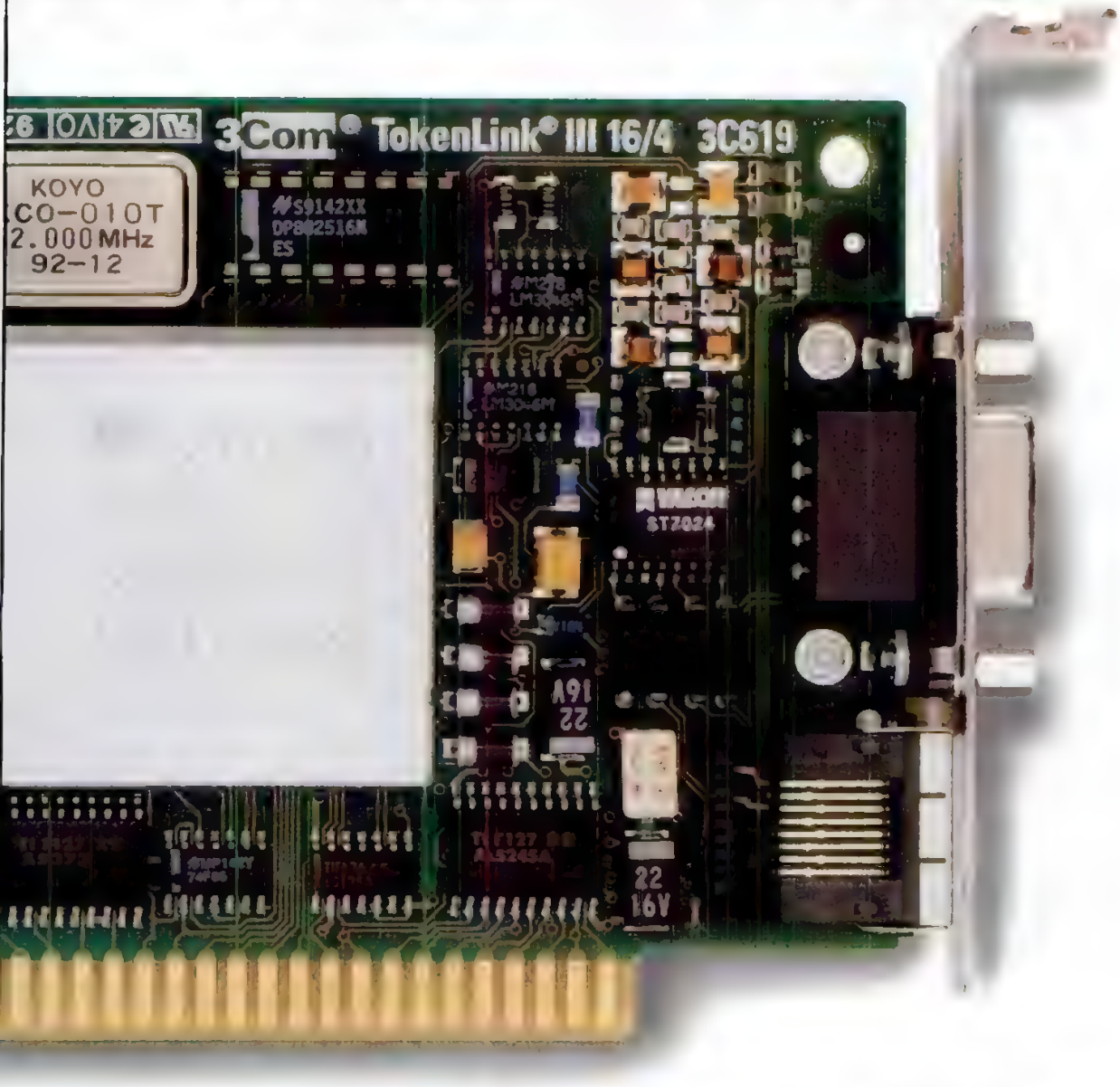

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Around the Token-Ring

by Frank J. Derfler, Jr.

To understand Token-Ring networks is to understand some of the fundamental principles of group communication. For a group of people to communicate, a certain protocol must be followed, whether it involves raising hands or following a set speaking order.

The same reasoning applies to computer networks. Unless there's some way of controlling who speaks when, effective communication is impossible. Vendors have developed several ways of solving this problem. Token-Ring is one solution; Ethernet is another. Because these architectures control access to the cabling, they are called *media access control (MAC) protocols.*

Like the different ways of determining who speaks when, MAC protocols have a few things in common. For one, each of the devices attached to the network has a name, called the *MAC-layer address.* Ethernet and Token-Ring send information in packets called *frames,* which are something like envelopes containing letters. Each frame has an originating address (called the source address) and a destination address, along with a message enclosed.

Beyond these basic similarities, the networks are vastly different. They operate at different line speeds. They have varying built-in capabilities built into the protocol. And they use slightly different procedures to determine who speaks when.

In the case of Token-Ring, devices can communicate at two speeds: 4 Mbps (megabits per second) or 16 Mbps. All of the adapters we reviewed for this story can operate at either speed. And with the exception of the IBM Token-Ring Network 16/4 Adapter/A, all of the adapters offer pretty much the same chip set to implement the Token-Ring protocol.

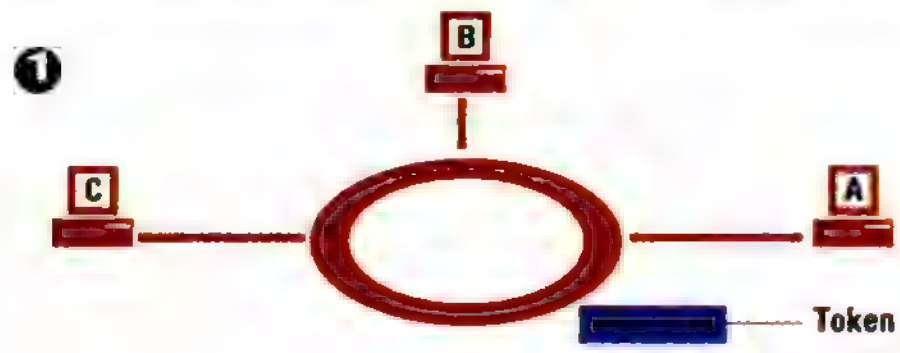
The concept of Token-Ring is pretty straightforward, although its actual functioning is much more complex. A frame, called a *token,* travels around the network. A station wanting to transmit data grabs hold of the token and flips a few bits in it when it arrives, and sends the frame on with the new data attached.

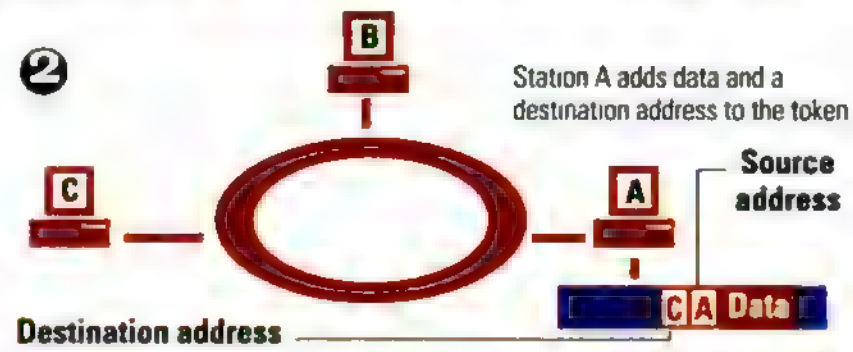
Each device on the network checks the destination address of the incoming message. If the station does not have the same address, the frame is ignored. If the station does have the same address as the frame's destination, it copies the data into memory and changes some more bits in the frame to indicate that the data has been properly received. The frame continues around the ring until it reaches the original sending station, which turns the busy token into a free token and releases it for the next user.

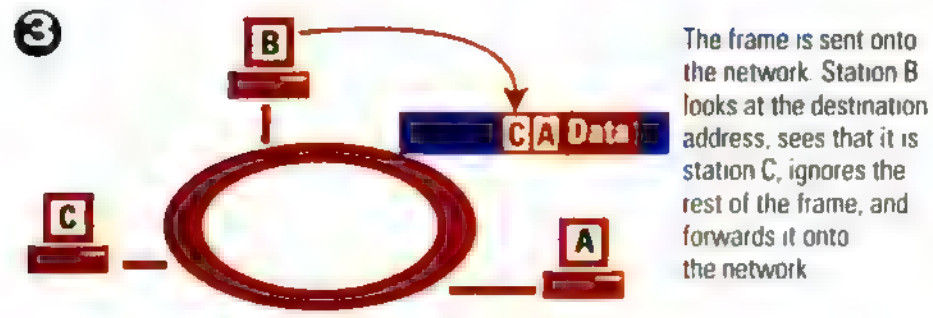
Initially, Token-Ring networks used a physical ring consisting of shielded twisted-pair cabling. Today, Token-Ring networks are typically laid out in a star topology, with a wiring hub known as the *Multistation Access Unit (MAU)* at the center, connecting devices over shielded or unshielded twisted-pair cabling (STP or UTP cabling). Many of the vendors whose adapters are reviewed here also sell MAUs. Together, these products give you a better-integrated solution for building a Token-Ring network. □

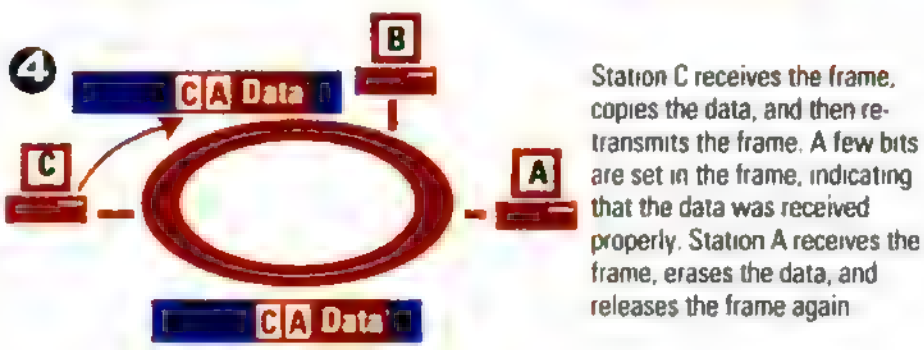
Token-Ring: A Station-to-Station Itinerary

A Token-Ring functions in a round-robin fashion. In a Token-Ring network, an electronic token—a frame—literally travels around an electronic ring. In this illustration, station A grabs the token (1). It adds the destination address (station C), the source address (A), and some data (2). The final frame is then sent onto the ring. Each station looks at the frame (3), but only the station with the right address receives the data (4). Once the data is copied, the frame is resent onto the network, where it is eventually released by station A (4).









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Mastering the Bus

by Winn L. Rosch

If you're really looking for a network performance fix, chances are you're going to want a bus-mastering Token-Ring adapter.

Bus mastering is a technique that temporarily moves control of the expansion bus from your system's microprocessor to the adapter. Instead of the PC managing the processing overhead involved in transferring data to and from another bus-mastering device, the adapter manages the data flow. Thus, the PC's processor can continue to handle other operations.

All advanced expansion buses, even 16-bit ISA, can support bus-mastering adapters (or "masters"). The difference between the various bus designs is in how a master gains control of the bus—a process called *arbitration*—and how the transfers are managed.

The 16-bit AT bus, unlike the 8-bit PC bus, allows a bus master to take command although it offers no additional management or arbitration capabilities. Problems can arise when multiple masters are installed in one PC, or when a single bus-mastering adapter attempts to return control to the microprocessor.

MCA, EISA, AND VL BUSES

The Micro Channel architecture (MCA) adds full management and arbitration capabilities. Bus masters bid for control by sending special signals that indicate the priority assigned to each master. The priorities are entirely flexible, assigned during the Programmable Option Select phase of the system configuration procedure. This procedure is used to assign interrupts, memory addresses, and all the other options that require DIP switches on ISA boards.

Arbitration is normally required for every word transferred by the bus master on any architecture, including MCA. But using a special transfer feature called *burst mode,* a master can perform multiple transfers without arbitration for as long as 15 milliseconds, the period needed to perform a memory refresh. EISA and VL buses also offer burst modes.

A transfer feature called burst mode *allows multiple transfers without arbitration for up to 15 milliseconds.*

In each arbitration cycle (with or without burst mode), if one or more masters are contending for control of the bus, MCA prevents the bus master in command from regaining control during the next arbitration cycle. The Micro Channel arbitration system can be programmed for linear priority or for fairness. With *linear priority,* control returns to the device of highest priority for every second arbitration cycle until the device's needs are fulfilled. If the arbitration system is programmed for *fairness,* all arbitrating masters are served once before any given master can regain bus control.

In EISA systems, arbitration is handled in cycles and epicycles (cycles within cycles).

Access to the bus rotates among three system functions: refreshing the memory, performing DMA (direct memory access) transfers, and giving control to the microprocessor or a bus-mastering adapter. And the opportunity to perform each function rotates among devices in accordance with priorities assigned to them.

In a given cycle, the arbitration mechanism runs through all three functions, with a different device qualifying to take control of each. For example, if in the first cycle the microprocessor gets control, in the next cycle a competing bus master gets control during the corresponding epicycle, and in the next cy-

Madge's MCA adapter, CNet's ISA adapter, and Accton's ISA adapter failed to communicate reliably. It's worth noting that all of the products worked in a relatively ideal electrical environment at a length of 412 feet of cable, more than twice the recommended cable span.

One reliability problem that we did not test for is a type of distortion called *jitter*. Jitter became an issue in large 16-Mbps Token-Ring installations, particularly those using unshielded twisted-pair wire, in late 1990. Jitter stems from two related problems: distortion being introduced by stations inaccurately reading network data and distortion becoming intensified when a signal travels around the ring. Action by a number of vendors has led to the general adoption of techniques that now control the problem.

Software drivers determine compatibility with operating systems and applications. Drivers need to support hundreds of calls to ensure complete compatibility. We conducted one test of IBM compatibility by running IBM LAN Server, Version 2.0. All the adapters that offer drivers for LAN Server were able to work under the program without any problem. Only the adapters from CNet and Anco came without drivers for LAN Server.

The CPU Utilization tests depict the impact of network traffic on a heavily loaded server. The adapters were tested using the default bus-master arbitration level setting provided by each individual vendor. Changing the arbitration level affects the adapter's percentage of CPU utilization. You can fine-tune this factor by changing the arbitration level, but you simultaneously affect throughput. CPU loading is an especially important factor if you want your file server to function as a gateway to midsize or mainframe computers, or even if you simply use it as an active print server.

Throughput is also important. While we saw marked throughput differences between adapters, they were apparent only under very heavy loads. You are not likely to see a difference in adapter

cle another bus master takes control. Or the microprocessor gets control again, if no other master is in contention or if the microprocessor has a high linear priority.

In the VESA local-bus design, priority is assigned to each of three possible bus-mastering devices, and the bus controller determines which master gets command. The design achieves fairness by forbidding a master to regain command of the bus until two cycles have elapsed after it loses control. EISA and the VL Bus also offer burst modes.

ADVANCED MODES

The Micro Channel can also improve bus throughput by using a streaming mode and data multiplexing. A *streaming data mode* allows a bus master to assert a starting address and send a block of data without further addressing. (Normal transfer procedures, even in burst mode, require the assertion of an address before the transfer of each word or double-word of data.) *Data multiplexing* allows the bytes of streaming data transfers to be carried across both the data and address lines of the bus, yielding a 64-bit effective data path.

With one bus master installed, any one of the three systems will yield about the same results. With multiple competing masters, however, the Micro Channel gives developers more flexibility to optimize performance. □

throughput on a client PC. At the server, however, the differences become appreciable; you won't want to limit your system by using an adapter with less than optimal throughput.

The price of these adapters ranges from $495 to $1,295. The least expensive is Anco's ISA product; Madge's EISA adapter is the most expensive. Price is a much more important consideration for client PCs than it is for servers, because you have to buy many more adapters for the client units.

LOOKING UPSTREAM

What's in store for Token-Ring adapters? With network adapters approaching the 16-megabit-per-server speed that is considered ideal, vendors are exploring a variety of ways to add value to their adapters.

One way is to improve the data interface between the adapter and the PC. A new breed of MCA-based PCs, such as IBM's PS/2 Model 95, will allow high-speed transfers using MCA streaming mode across the backplane. Madge has released its Smart 16/4 MC32 Ringnode, which also takes advantage of MCA streaming mode. IBM is expected to release a similarly capable MCA board.

Attempts to make better use of the Token-Ring controller are also sure to start drawing attention soon. The TI TMS380C16, the controller used in most Token-Ring adapters, is a full 16-bit microprocessor. Some reports estimate its performance to be equal to that of a 10- or 12-MHz 80286. With the exception of Madge and Proteon, most vendors have largely ignored the capabilities of the TMS380C16, however.

Proteon's efforts involve a set of tools called ACE (Advanced Computing Environment), which Texas Instruments began providing late last year. These tools run applications directly on the chip set.

Proteon has used ACE to improve the speed of its Token-Ring adapters and has announced plans to use ACE to run a management agent and SNA (Systems Network Architecture) software on the controller itself. DCA is expected to use ACE to provide similar capabilities with its adapters.

Whether or not Proteon, DCA, and other Token-Ring vendors throw their weight behind ACE may hinge on the emergence of the new Token-Ring chip sets from Chips & Technologies, IBM, National Semiconductor, and Western Digital. With such other sources of Token-Ring controllers to choose from, adapter vendors will have to think twice before investing their resources in developing the TMS380.

Texas Instruments won't rest on its laurels, however. Its new dual-protocol chip, the TMS380C26 Super Eagle, combines the Token-Ring capabilities of its present popular chip set with the Ethernet protocol. Texas Instruments will become one of the first vendors of chip sets to team up with a PC manufacturer, Compaq, in providing a network-ready PC (see the sidebar "Network-Ready PCs Arrive"). TI has also announced a wiring technique called SPLIT (Selectable Physical Layer Interface Transceivers) that makes it easier to put the TMS380C26 chip set on a PC's motherboard while keeping wire connections flexible.

Chips & Technologies has announced a similar product, ChipsLAN, a dual-protocol chip set that is scheduled for release in the third quarter of 1992. Advanced Micro Devices (AMD) has announced its intention to produce a similar product. The goal of these vendors is to integrate the network controller into the PC, thus selling more chips at lower prices.

All of this means good news for the customer. With lower prices and greater functionality, Token-Ring will stay competitive as new standards emerge.

Accton Technology Corp.

Accton RingPair 4/16

BY M. KEITH THOMPSON

The performance of the Accton RingPair 4/16 clearly illustrates how important a software driver is to an adapter card. The Accton RingPair 4/16 uses the same chip set as its competitors, but its IPX (Internet Packet Exchange) driver slows it down significantly. Accton Technology Corp.'s new ODI (Open Data-link Interface) driver vastly improves performance, but also increases the product's CPU Utilization scores.

The combination of the Accton adapter's test results and a price tag that's

FACT FILE

Accton RingPair 4/16

Accton Technology Corp., 46750 Fremont Blvd., #104, Fremont, CA 94538; 800-926-9288, 510-226-9800; fax, 510-226-9833

List Price: $799

In Short: A middle-of-the-pack adapter card for ISA computers, the Accton RingPair 4/16 is a slow performer under its IPX driver; throughput improves when you use its ODI driver instead. Accton also makes an $829 Micro Channel adapter, the RingPair MC 4/16, and an external adapter, the $699 RingPocket 4/16, that received Editors' Choice in our January 14, 1992, issue

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as high as some of the leading adapters on the market makes Accton's ISA device hard to recommend for either a client or server PC.

Accton is one of the few vendors to market both portable and internal Token-Ring adapters. We looked at the RingPair 4/16, a $799 ISA adapter. Accton also makes the RingPair MC 4/16, an $829 Micro Channel adapter that arrived too late for formal benchmark testing, as well as the RingPocket 4/16, a previous Editors' Choice–winning $699 external adapter. (For more information, see "External Token-Ring Adapters: Plug and Play—and Pay?" *PC Magazine*, January 14, 1992.) In addition to Token-Ring adapters, Accton manufactures eight-port multistation access units (MAUs) for shielded (STP) and unshielded twisted-pair cable (UTP).

Accton includes drivers for Novell's NetWare and Microsoft LAN Manager with the RingPair 4/16, but sells IBM LAN Support drivers for $49. NetWare drivers come in both DOS and OS/2 versions for ODI, and a DOS version for IPX. The NDIS (Network Driver Interface Specification) drivers for LAN Manager also work with 3Com's 3+Open and Banyan's VINES.

The ISA adapter uses jumpers that are easy to find and change, while the MCA adapter uses an Adapter Description File for configuration. The ISA and MCA products work as bus masters and include 128K of RAM.

The performance of the RingPair 4/16 was slightly below average with 512-byte packets and well below average when we increased the packet size to 4K. Upon investigation, we found that the IPX driver could handle only 2K blocks of data and broke all 4K frames into two packets, producing slow test results and a Performance Index of 0.84, the lowest of any ISA card on the 4K-packet test. The Accton device passed the Cable Lobe Length test at 462 feet, but failed to communicate at 512 feet.

Accton's ODI driver roughly doubled the card's throughput by extending the maximum packet length to 4K. The new driver also increased the CPU overhead, however.

Although the RingPair manual is small, its detailed charts that show the adapter's jumper settings and locations

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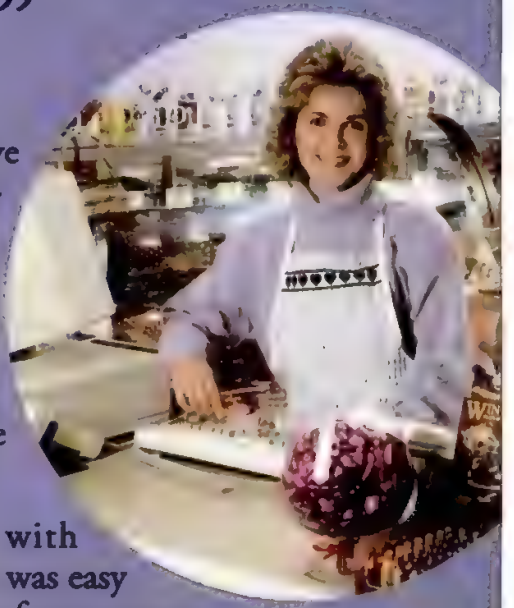

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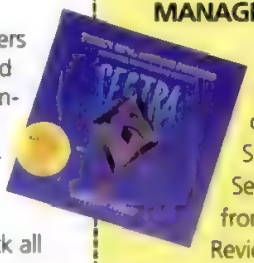

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Benchmark Tests: Token-Ring Adapters

Among EISA adapters, Madge's Smart 16/4 EISA Ringnode ranks at the top in performance; it is the priciest as well. Even though the Anco T2002 is not the fastest of the ISA adapters, it offers outstanding performance for the lowest price. In the MCA category, the Thomas-Conrad TC4046 soars ahead of its competitors, scoring highest in three of the four Performance Index ratings.

HOW WE TESTED

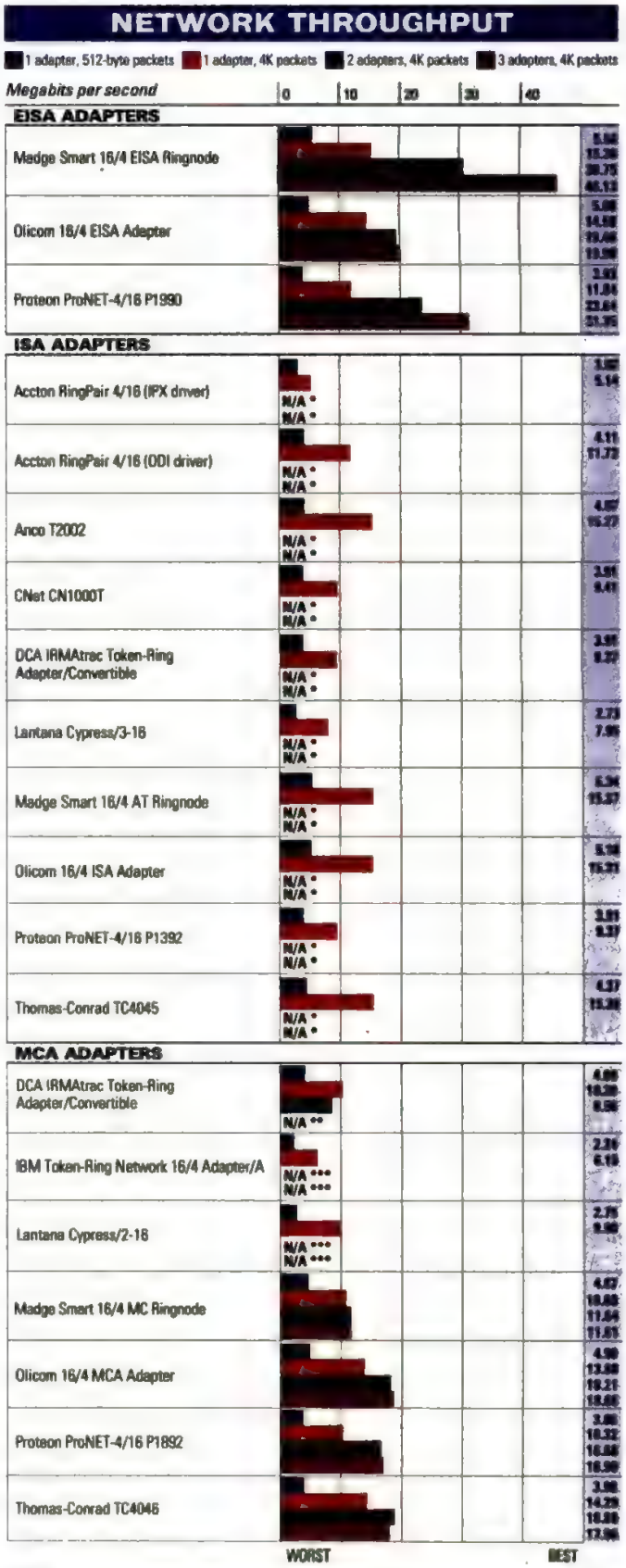
We tested all of the adapters on a NetWare 3.11 network consisting of three clients running DOS 5.0 and one server connected via the Cabletron Concentrator TRMIM-22, a passive hub. We used the default settings for each adapter. Some adapters, particularly the MCA products, may show better results under different conditions. We installed the EISA and ISA adapters in a Compaq 486/33M Deskpro with 8MB of RAM and a 120MB hard disk. We ran the MCA adapters in the IBM PS/2 Model 90, a 33-MHz 486 machine with 8MB of RAM and a 150MB hard disk. Each adapter vendor supplied its own drivers.

We ran four sets of tests from the Network Interface Card (NIC) Throughput group from ZD Labs' benchmark test suite, NetBench, Version 1.0. These tests flooded the network with 512-byte and 4K packets. These packets simulate particular types of typical network traffic. Applications reading and writing to a file over a network primarily use 512-byte packets; file transfers typically use 4K packets. We also wanted to see how a file server with two and then three of these adapters could handle multiple file transfers of large packets simultaneously; the 4K packets allowed us to saturate the line more easily when we were testing with multiple adapters.

The **Network Throughput** tests measure the amount of data an adapter can transmit over the network, in megabits per second. We installed each vendor's adapters in the server and client PCs, and used NetBench to create a traffic flow of 512-byte and 4K frames. Ideally, these adapters should produce network throughputs as high as 16 megabits per second.

The **CPU Utilization** tests measure the amount of overhead the adapter adds to the server, particularly under heavy traffic loads. For the EISA and MCA adapters, we ran separate tests with one, two, and three adapters installed in the server, and we report the percentage of CPU utilization for each configuration. For each ISA product, we installed only one adapter in the server, because in this configuration the percentage of CPU utilization was already approaching the saturation point and because an ISA product is not likely to be used in multiple-adapter configurations.

The **Performance Index** (PI) shows the ratio of network utilization to CPU utilization; high throughput at the expense of a crippled server would clearly be undesirable. We give each adapter a network-utilization rating based on the Network Throughput test score, on a scale where 16 megabits per second would become a rating of 100. We then divide this score by the CPU Utilization test score to determine the performance index. The higher the number, the better the adapter.



*N/A—Not applicable. We did not test the product in this configuration, which falls outside its primary intended use.
**N/A—Not applicable. The size of this adapter prevented us from installing three in one server
***N/A—Not applicable. The product did not complete the test in this configuration.

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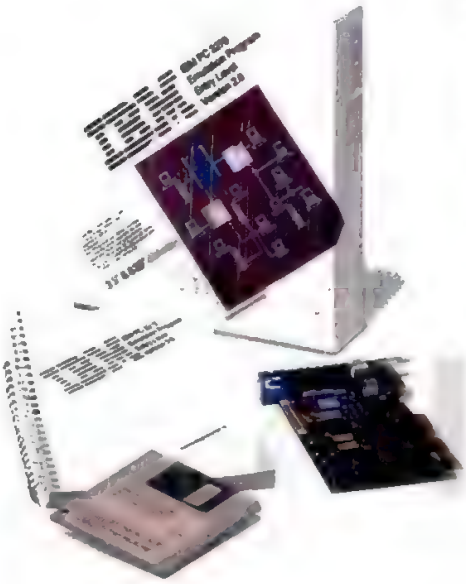

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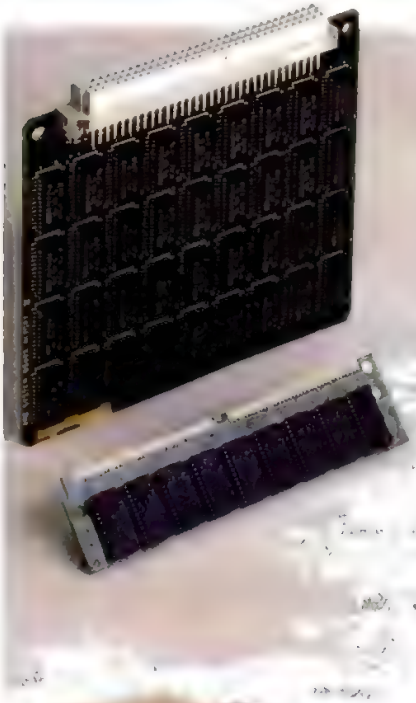
DOS Upgrade 3.5" 84F9776, 5.25" 84F9778	$55



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If you want to use OS/2 to support personal productivity applications, multitasking or server functions, but need more power, try these options:

System Memory Options

Spd	Part No.	PS/2 Models	Now
2MB:			
70ns	6450902	25SX, 35, 40, 56, 57, P75, 90, 95	$145
80ns	6450379	80-111/121/311	$130
80ns	6450608	25SX, 35, 40, 70-AXX/BXX, 90, 95	$130
80ns	87F9856	70, P70, 80	$430
85ns	6450604	25SX, 35, 40, 50, 55, 65, 70-E61/061/081/121/161, P70, 90, 95	$130
4MB:			
70ns	6450128	25SX, 35, 40, 56, 57, P75, 90, 95	$265
80ns	87F9977	25SX, 35, 40, 55, 65, 90, 95	$260
8MB:			
70ns	6450130	25SX, 35, 40, 56, 57, 90, 95	$625
80ns	6450129	25SX, 35, 40, 90, 95	$530

* Binder not included.

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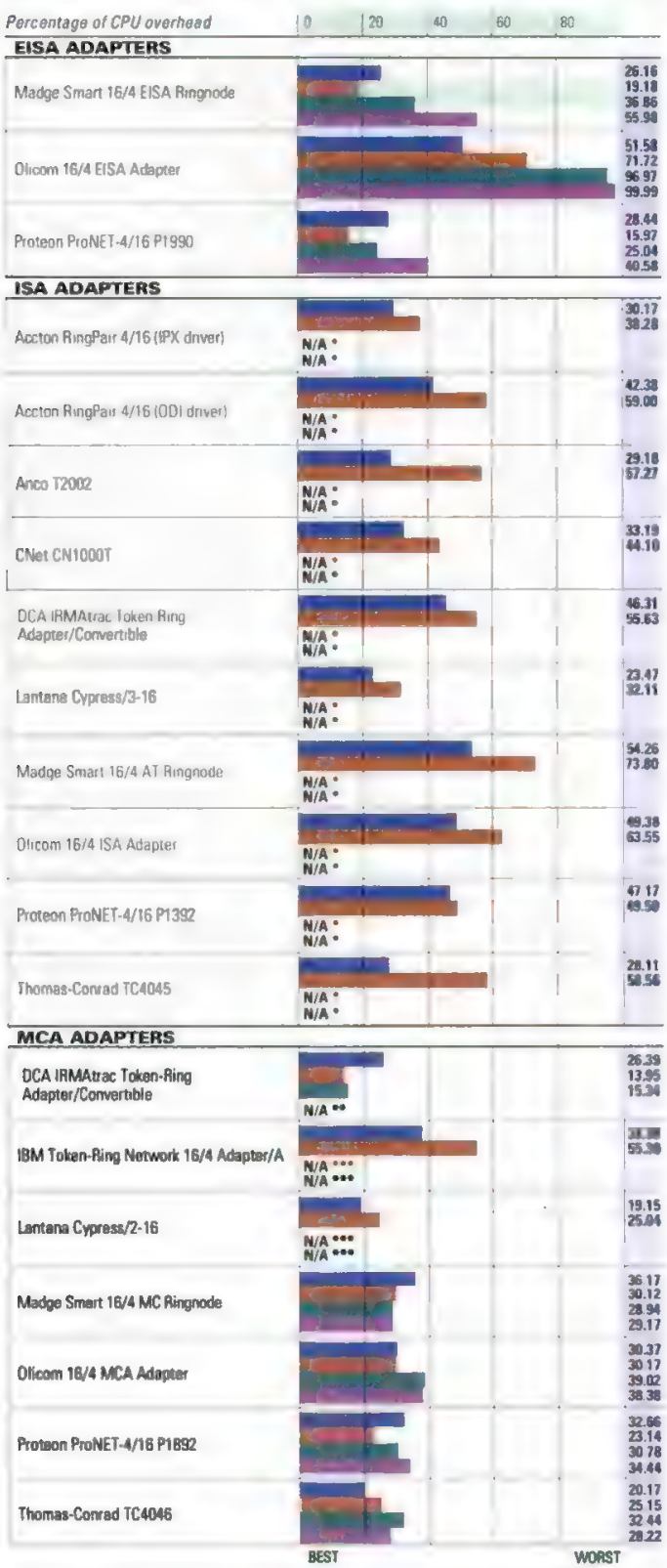
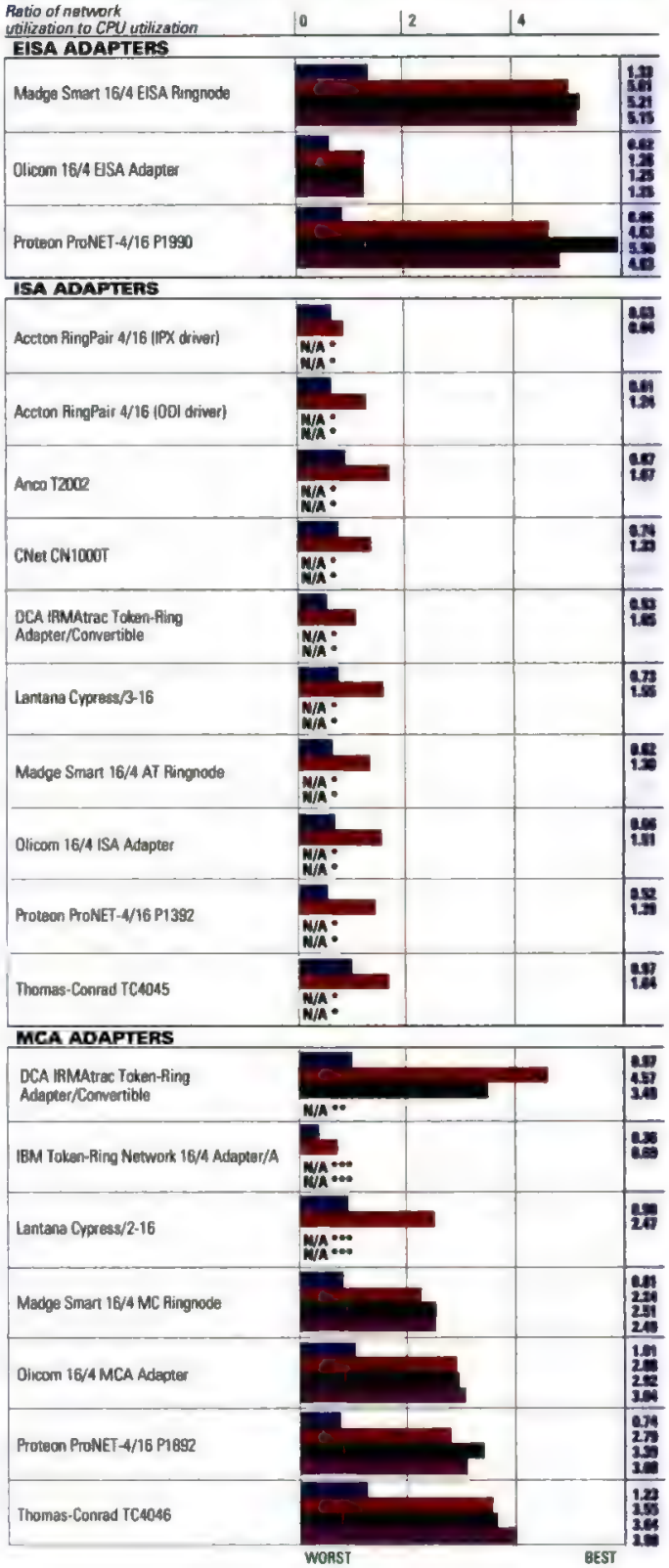
Benchmark Tests: Token-Ring Adapters

CPU UTILIZATION



PERFORMANCE INDEX



*N/A—Not applicable. We did not test the product in this configuration, which falls outside its primary intended use
**N/A—Not applicable. The size of this adapter prevented us from installing three in one server
***N/A—Not applicable. The product did not complete the test in this configuration

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CIRCLE 312 ON READER SERVICE CARD

Network-Ready PCs Arrive

by David Greenfield

Wouldn't it be wonderful just to buy a network the way you buy a PC? You know, get a box, open it up, and poof! In 2 minutes you're attached to a network.

It may sound too good to be true, but in the next few months the network-ready PC is sure to become one of the hottest product categories around. Vendors like Compaq are getting set to cut the cost and complexity of networking with a new breed of PCs that are ready for connecting right out of the box. No network adapters to install. No DIP switches to set. Just turn the unit on, connect a cable, add a network operating system or drivers, and your PC is ready to network.

Enabling this quiet revolution is a new breed of chip sets that execute both the Ethernet and Token-Ring protocols. Vendors have long resisted adding networking hardware to PC motherboards, even when there was a demand. With Ethernet dominating the networking market but IBM backing Token-Ring, no one clear networking solution emerged. Now, with dual-protocol chip sets, vendors won't have to stock two separate product lines. They'll have one solution for both environments.

The first PCs expected to benefit from the integrated chip sets will be file servers. Next month, Compaq will become the first vendor to ship a network-ready PC, a Systempro based on the Super Eagle chip set from Texas Instruments.

The upcoming Systempro will integrate the Super Eagle chip set as a standard feature. Making the Super-Eagle an integral part of the system design will not only provide something closer to a plug-and-play solution but will offer enhanced network performance at a cost several hundred dollars lower than comparable solutions available today, according to Mike Perez, Compaq's director of systems development.

Some pitfalls may await vendors and users who jump too quickly into the world of the networked PC. Software drivers are a potential problem. Much of the speed of today's network adapters rides on the efficiency of the drivers. Gaining the expertise to build efficient driver code is no simple task, and vendors must be prepared to make the investment.

A second potential hurdle may be one of perception. PCs require more than simply a network connection before they can be considered truly network-ready. They demand the right software, whether it's NetWare or TCP/IP. You will still have to deal with the installation process.

Part of the solution, at least to the second problem, may be resolved with the next generation of high-end operating systems, such as Windows NT and Windows for Workgroups, a network-ready version of Microsoft Windows. These products have networking built-in. If Compaq packages the Systempro, a server, with NT, a server platform, you may truly get the transparent networking access you need. □

make configuration quick and simple. The only documentation on the drivers is supplied in a README file, however. Accton does rise above the pack, along with Lantana and Proteon Technology, by offering a lifetime warranty for the RingPair 4/16.

The Accton RingPair 4/16 fits in the middle of the Token-Ring pack. While the product doesn't offer any exceptional features to match the self-configuring drivers from Madge Networks, for example, the Accton adapter certainly doesn't lack such necessities as bundled software drivers.

Anco Electronics Inc.

Anco T2002

BY STEVE RIGNEY

Low price and good performance make the Anco T2002 a great choice for ISA client and server PCs. At $495, this 4/16-

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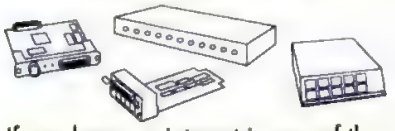

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CIRCLE 185 ON READER SERVICE CARD

▶ SUMMARY OF FEATURES

16-Mbps Token-Ring Adapters

Products listed in alphabetical order

■ = YES □ = NO	Accton RingPair 4/16	Anco T2002	CNet CN1000T	DCA IRMAtrac Token-Ring Adapter/ Convertible	IBM Token-Ring Network 16/4 Adapter/A	Lantana Cypress/2-16
List price	$799	$495	$649	$895	$895	$625
Physical Characteristics						
Bus interface	16-bit	16-bit	16-bit	16-bit	16-bit	16-bit
Bus architecture	ISA	ISA	ISA	ISA, MCA	MCA	MCA
Cabling supported	STP, UTP	STP, UTP	STP, UTP	STP, UTP	STP	STP, UTP
Total amount of buffered RAM	128K	128K	128K	128K	64K	128K
Remote program load	□	■	□	■	■	■
Drivers Supported						
LANtastic	□	□	□	□	■	□
NDIS	■	■	■	■	■	■
NetBIOS	■	■	□	■	■	■
ODI	■	■	■	■	■	■
VINES	■ (workstation only)	■ (workstation only)	■ (workstation only)	■ (workstation and server)	■ (workstation and server)	□
Protocols on adapter	None	None	None	None	None	IPX, NetBEUI
Data-Transfer Technique						
Shared memory	□	□	□	□	■	□
Bus-mastered DMA	■	■	■	■	□	■
Programmed I/O	■	■	■	■	■	□
Other Token-Ring Products						
Multistation Access Unit	□	□	□	□	■	■
Macintosh adapter	□	□	□	■	□	□
Token-Ring-to-Token-Ring bridge	□	□	□	□	■	□
Token-Ring-to-Ethernet bridge	□	□	□	□	■	□
Configuration Options						
I/O port choices	A20–0A31, 1A20–1A31, 2A20–2A31, 3A20–3A31	1A20, 2A20, 3000–3FF0	A20, A24, A50, A54	A20, 1A20	None	1A20, B20, 1B20
IRQ choices	3–12	2–7, 10–12	2–3, 5, 10-12	2–3, 5, 7 (ISA); 2–3, 10–11 (MCA)	2–3, 10–11	3, 5, 7, 11, 15
DMA choices	5–7	3	5, 8–14	5–6 (ISA); 4–7 (MCA)	N/A	None

N/A—Not applicable: The product does not have this feature

Mbps card is the least expensive Token-Ring adapter card reviewed here.

A 16-bit bus-master adapter, the T2002 contains 128K of memory, diagnostic LEDs for basic troubleshooting, and connectors for Type 1, 2, 6, or 9 shielded and Type 3 unshielded twisted-pair cable.

You can easily configure the Anco T2002 through jumpers and DIP switches. Its drivers run under OS/2 and DOS on NetWare, LAN Manager, and Token-Ring networks that use the LLC/AHI (Logical Link Control/Adapter Handling Interface) standard.

Among ISA adapter cards, the low-priced Anco T2002 performed well, equaling or surpassing many of its more expensive competitors.

The Anco T2002 performed well, ranking among the highest on the Network Throughput tests, along with the Madge, Olicom, and Thomas-Conrad devices. The T2002 also did well on the CPU Utilization tests. The Anco T2002 completed all three lengths on our Cable Lobe Length tests.

The Anco T2002 was available only as an ISA adapter during our tests, but Anco Electronics plans to be shipping a switchable MCA card, based on the IBM chip set, by the time you read this. Anco

Lantana Cypress/3-16	Madge Smart 16/4 AT Ringnode	Madge Smart 16/4 EISA Ringnode
$625	$945	$1,295
16-bit	16-bit	32-bit
ISA	ISA	EISA
STP, UTP	STP, UTP	STP, UTP
128K	128K	256K
■	■	■
□	■	■
■	■	■
■	■	■
■	■	■
□	■ (workstation and server)	■ (workstation and server)
IPX, NetBEUI	IPX, NetBEUI	IPX, NetBEUI
□	□	□
■	■	■
■	■	□
■	■	■
□	□	□
□	■	■
□	□	□
1A20, B20, 1B20	A20, 1A20, 2A20, 3A20	None
3, 5, 7, 11–12	2–3, 5, 7, 10–12, 15	2–3, 10–12, 15
0, 5-7	1, 3, 5–6	None

CONTINUES

also offers a $695 8-bit ISA card using IBM's chip set, as well as multistation access units for shielded and unshielded twisted-pair media for $425 each.

Anco provides well-written, thorough documentation on installation, and a five-year warranty for its product. The Anco T2002 offers a good network solution at a reasonable price, with performance equaling or surpassing many of its more expensive ISA competitors. The MCA adapter, though not available at the time of our review, should also be worth investigating.

PC EDITORS' CHOICE

FACT FILE

Anco T2002

Anco Electronics Inc., 140 North Palm St., Brea, CA 92621; 800-545-2626, 714-992-9000; fax, 714-992-1672

List Price: $495

In Short: Strong performance, low CPU utilization, and a low price make Anco's T2002 Token-Ring adapter a great choice for client as well as server PCs. It was available only for ISA buses at the time of testing, although a 16/4 MCA adapter should now also be shipping

552 ON READER SERVICE CARD

CNet Technology Inc.

CNet CN1000T

BY STEVE RIGNEY

If you get headaches just thinking about fiddling around with your PC, you might want to pass on CNet's CN1000T adapter card. Its average performance won't compensate for its complex configuration, inadequate documentation, and limited network operating system (NOS) support. And at $649, the 16-bit ISA adapter card is not even the least expensive among the adapters we review.

CNet Technology claims that the CN1000T runs with IBM PC LAN, Novell's NetWare, Microsoft LAN Manager, and 3Com's 3+Open. We were able to use the adapter with NetWare and Microsoft LAN Manager, but it wasn't easy.

CNet provides drivers for NetWare only (along with the diagnostic software to test the adapter), and the documentation doesn't describe specific network operating systems. Although the CN1000T mimics a standard IBM Token-Ring adapter, for which most NOSs provide a driver, there are 20 DIP switches and jumpers you must change, including a DIP switch with 12 choices. CNet leaves it to you to configure the card and make it work with the particular brand of networking software you are using. The adapter also includes connectors for shielded and unshielded twisted-pair cable as well as 128K of RAM and DMA (direct memory access) bus mastering.

The manual's not much better. Its only laudable feature is an appendix explaining and illustrating Token-Ring cabling and connector components. But the documentation lists the card's base I/O address options only in hexadecimal, a possible problem for inexperienced users. The product comes with a five-year warranty.

The CN1000T performed well, but not outstandingly, on the Network Throughput and CPU Utilization tests. It ranked behind the Smart 16/4 AT Ringnode, the Thomas-Conrad TC4045, the Olicom 16/4 ISA Adapter, and the Anco T2002 on the Throughput tests and also placed near the middle of the pack on the CPU Utilization tests. The CN1000T's Performance Index was also near the middle.

Although the CN1000T mimics a standard IBM adapter, there are 20 DIP switches and jumpers to change, including a DIP switch with 12 choices.

The adapter was able to communicate only at 412 feet in the Cable Lobe Length tests, failing at 462 and 512 feet.

For users who are committed to the CN1000T, CNet Technology also makes eight-port STP and UTP multistation access units ($479 and $399 respectively) to tie the adapters together. The CN1000T is more suitable as a client adapter than as a server adapter.

FACT FILE

CNet CN1000T

CNet Technology Inc., 2199 Zanker Rd., San Jose, CA 95131; 408-954-8000; fax, 408-954-8866

List Price: $649

In Short: The CNet CN1000T performed well on our Network Throughput and CPU Utilization tests, but lacks thorough documentation and sufficient network software drivers. This ISA adapter is designed for the experienced user, not the novice.

553 ON READER SERVICE CARD

▶ SUMMARY OF FEATURES

Products listed in alphabetical order

■ = YES □ = NO

	Madge Smart 16/4 MC Ringnode	Olicom 16/4 EISA Adapter	Olicom 16/4 ISA Adapter	Olicom 16/4 MCA Adapter	Proteon ProNET-4/16 P1392	Proteon ProNET-4/16 P1892
List price	$945	$950	$895	$895	$795	$795
Physical Characteristics						
Bus interface	16-bit	32-bit	16-bit	16-bit	8/16-bit	16-bit
Bus architecture	MCA	EISA	ISA	MCA	ISA	MCA
Cabling supported	STP, UTP	STP, UTP	STP, UTP	STP, UTP	STP, UTP	STP, UTP
Total amount of buffered RAM	128K	128K	128K	128K	128K	128K
Remote program load	■	■	■	■	■	■
Drivers Supported						
LANtastic	■	■	■	■	□	□
NDIS	■	■	■	■	■	■
NetBIOS	■	■	■	■	■	■
ODI	■	■	■	■	■	■
VINES	■ (workstation only)	■ (workstation and server)	■ (workstation and server)	■ (workstation and server)	■ (workstation and server)	■ (workstation and server)
Protocols on adapter	IPX, NetBEUI	None	None	None	IPX, NetBEUI, TCP/IP	IPX, NetBEUI, TCP/IP
Data-Transfer Technique						
Shared memory	□	□	□	□	□	□
Bus-mastered DMA	■	□	■	■	■	■
Programmed I/O	■	■	■	■	■	■
Other Token-Ring Products						
Multistation Access Unit	■	■	■	■	■	■
Macintosh adapter	□	□	□	□	□	□
Token-Ring-to-Token-Ring bridge	■	■	■	■	■	■
Token-Ring-to-Ethernet bridge	□	□	□	□	■	■
Configuration Options						
I/O port choices	A20, 1A20, 2A20, 3A20	A20–A23, A30–A3F, A24–A27, A40–A4F, A50–A53, A60–A6F, A54–A57, A70–A7F	A20–A23, A30–A3F, A24–A27, A40–A4F, A50–A53, A60–A6F, A54–A57, A70–A7F	A20–A23, A30–A3F, A24–A27, A40–A4F, A50–A53, A60–A6F, A54–A57, A70–A7F	A20–FE20	71C0, 71D0, 75C0, 75D0, 79C0, 79D0, 7DC0, 7DD0
IRQ choices	2, 3, 10	2–3, 10–11	2–3, 10–11	2–3, 10–11	2–7, 10–12	3–5, 10–12, 14–15
DMA choices	None	None	5, 6, 7	8–14	5–7	0–14

N/A—Not applicable: The product does not have this feature

Digital Communications Associates Inc.

DCA IRMAtrac Token-Ring Adapter/Convertible

BY STEVE RIGNEY

Whether you have a PS/2 Model 80 or an AT clone, the DCA IRMAtrac Token-Ring Adapter/Convertible could be the adapter card for you. Priced at $895, the device is a 16/4-Mbps, 16-bit bus-master adapter designed to work in an ISA, MCA, or 16-bit EISA bus PC. Perfect for corporate accounts that wish to stock only a single adapter, the easy-to-configure card showed average throughput and low CPU utilization on our tests.

DCA packages the IRMAtrac as a kit. The main board has ISA connections on one edge and MCA connections on the other, and you must use a screwdriver to attach an appropriate end plate and a daughterboard that contains the adapter electronics. Assembly takes only 3 to 5 minutes, but the added space the daughterboard requires can be a disadvantage in a crowded PC expansion bus.

DCA provides drivers for Banyan's VINES, IBM LAN Server, IBM PC LAN, Novell's NetWare, Microsoft LAN Manager, 3Com's 3+Open, and other NetBIOS-compliant LANs. The card includes shielded and unshielded twisted-pair connectors, as well as 128K of on-board RAM, expandable to 2MB. You can offload processing from the PC to the on-board memory.

Although unique in design, DCA's IRMAtrac is average in performance, with throughput roughly comparable to

Proteon ProNET-4/16 P1990	Thomas-Conrad TC4045	Thomas-Conrad TC4046
$995	$795	$750
32-bit	16-bit	32-bit
EISA	ISA	MCA
STP, UTP	STP, UTP	STP, UTP
128K	128K	128K
■	■	■
□	■	■
■	■	■
■	■	■
■	■	■
■	■	■
(workstation and server)	(workstation only)	(workstation only)
IPX, NetBEUI, TCP/IP	None	None
□	■	■
■	■	■
■	□	□
■	□	□
□	□	□
■	□	□
■	□	□
None	1A20, 2A20, 3000–3FF00	1A20–8A2F
2, 5, 10–12	2–7, 10–12	2–4, 10–12, 14–15
None	1, 5–7	0–14

ENDS

CNet's ISA and Proteon's MCA cards. Its CPU utilization also landed in the middle as an ISA adapter, although the adapter did well on large block sizes as an MCA adapter. Not surprisingly, its Performance Index was a midrange 1.05 for 4K packets among ISA cards; but as an MCA card, it had the best index at 4.57 for 4K packets (one adapter). On the Cable Lobe Length tests, it passed at 512 feet in both configurations.

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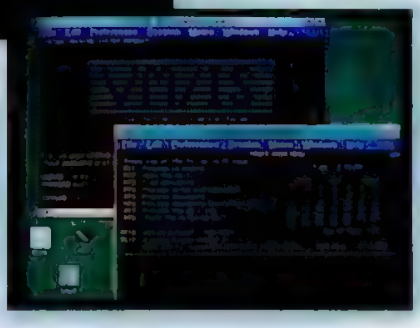

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CIRCLE 211 ON READER SERVICE CARD

FACT FILE

DCA IRMAtrac Token-Ring Adapter/Convertible

Digital Communications Associates Inc., 1000 Alderman Dr., Alpharetta, GA 30202-4199; 800-274-6633, 404-442-4000; fax, 404-442-4366

List Price: $895

In Short: Great flexibility and good performance make DCA's IRMAtrac Token-Ring Adapter/Convertible a logical choice for companies that want to limit the number of adapters they keep in stock. The IRMAtrac is really two adapters in one. It performed adequately as an ISA adapter on our tests but was a real winner as an MCA adapter.

554 ON READER SERVICE CARD

the MacIRMAtrac line of Token-Ring adapters for the Macintosh. A 4-Mbps MacIRMAtrac adapter costs $795 and a 4/16-Mbps adapter costs $895. Multistation access units (MAUs) are also available to tie those stations together. Unshielded and shielded twisted-pair eight-port MAUs are priced at $575. A 16-port MAU for fiber-optic cable costs $4,995. DCA also sells the UTP/STP RIM, a ring-interface module for upgrading 4-Mbps PC-based IRMAtrac adapters to 16-Mbps unshielded twisted-pair or fiber-optic networks, for $195.

The multivolume documentation is well written. DCA supplies a one-year warranty for the card and covers the software for 90 days.

The IRMAtrac is ideal for an organization with a mix of ISA and MCA client PCs. Its flexibility and common set of drivers can keep down the cost of spares, making life a lot simpler for network administrators.

IBM Corp.

IBM Token-Ring Network 16/4 Adapter/A

BY M. KEITH THOMPSON

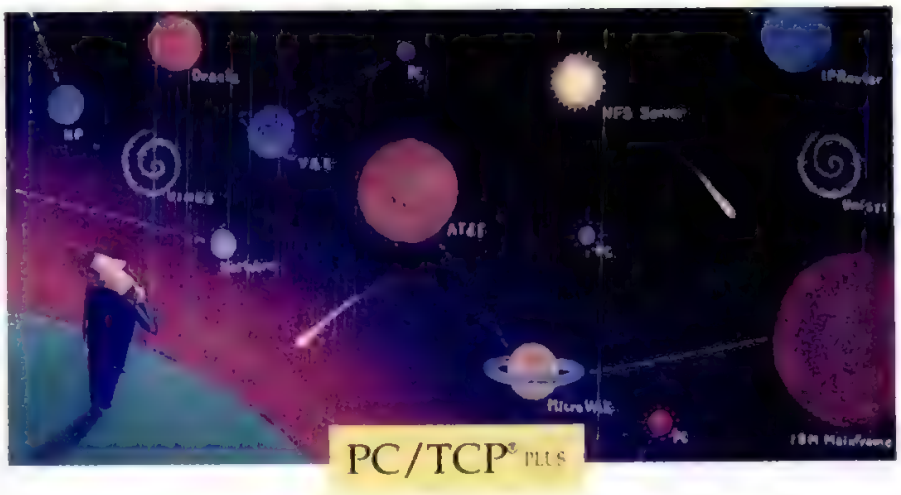
The original proponent of Token-Ring networks, IBM has by far the broadest, most complete Token-Ring product line on the market today.

Yet if performance and price are the yardsticks you use in measuring adapter cards, IBM's Token-Ring Network 16/4 Adapter/A falls short. The 16-bit MCA adapter, priced at $895, offers mediocre performance at a high price. It does, however, feature compatibility with IBM computers and other IBM Token-Ring products, as well as strong support.

Although IBM, along with SynOptics Communications, developed the standard for Token-Ring over unshielded twisted-pair cable, the 16/4 Adapter/A comes equipped with only a standard shielded twisted-pair cable connector. IBM also does not offer an EISA model.

The 16/4 Adapter/A is a cinch to install. Microsoft, Novell, and Banyan provide drivers for IBM Token-Ring adapters in their network operating systems, and the 16/4 Adapter/A is software-configurable. IBM offers a wealth of shared-

There's only one way to get around out here.



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*PC/TCP Plus supports interfaces from Acer, Allied Telesis, Apricot, AT&T, BICC, DEC, D-Link, DSC, Excelan, Gateway Communications, IBM, IMC Networks, Intel, Interlan, Longshine, MCAssociates, National Semiconductor, Novell, Proteon, Schneider & Koch, Scope, HiNet, 3Com, Tiara, Torus, TRW, Ungermann-Bass, Univation, Western Digital and YCS, in addition to the ASI, NDIS and Packet Driver specifications.

CIRCLE 031 ON READER SERVICE CARD

FACT FILE

IBM Token-Ring Network 16/4 Adapter/A
IBM Corp., Old Orchard Rd., Armonk, NY 10504; 800-426-3333

List Price: $895.
In Short: The IBM Token-Ring Network 16/4 Adapter/A doesn't feature the best performance or the lowest price tag, but IBM is the standard for Token-Ring compatibility and its adapter offers great reliability. IBM also makes another Micro Channel adapter, the IBM Token-Ring Network 16/4 Busmaster Server Adapter/A, priced at $1,030. The Server Adapter/A can work either in a server or an OS/2 client, but lacks the performance of some other high-speed MCA adapters, such as Madge's Smart 16/4 MC Ringnode.
555 ON READER SERVICE CARD

memory choices with the 16/4 Adapter/A, which gives you flexibility in assigning memory locations to cards.

The 16/4 Adapter/A ranked near the bottom on our tests, mainly because it uses shared memory rather than bus mastering to move data between the host and the adapter. The lack of bus mastering is reflected in the 16/4 Adapter/A's high CPU Utilization score in its default configuration while under heavy load. The IBM adapter achieved a Performance Index score of 0.69, the lowest among MCA adapters, for 4K packets. It was, however, able to communicate at 512 feet, the longest distance on our Cable Lobe Length tests, a plus for companies that are located far from the wiring hub.

IBM can provide a full line of Token-Ring products and the expertise needed to combine those products into a cohesive network.

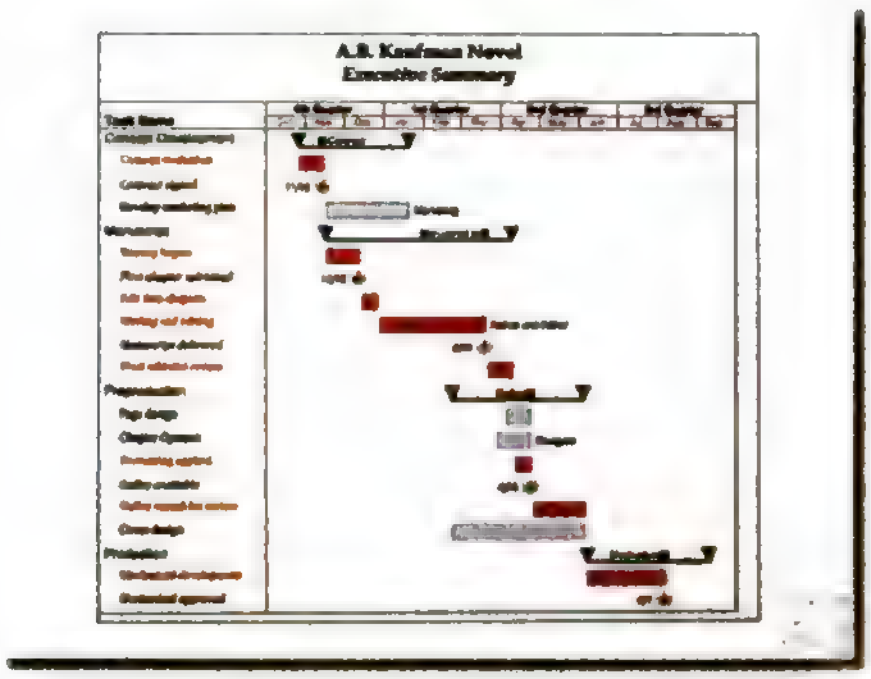
The IBM adapter's scores may not be irredeemable, however. If you alter the 16/4 Adapter/A's default configuration and play with the arbitration levels in the MCA server, the device may exhibit better performance. Tweaking the arbitration levels in the PC may also improve CPU overhead, but these adjustments may affect the performance of other network adapters that are loaded into the server.

IBM also markets a bus-mastering server adapter, the 16/4 Busmaster Server Adapter/A, a 32-bit device priced at $1,030. Since the 16/4 Busmaster Server Adapter/A works only as a server or OS/2 client, we were not able to include it in our tests.

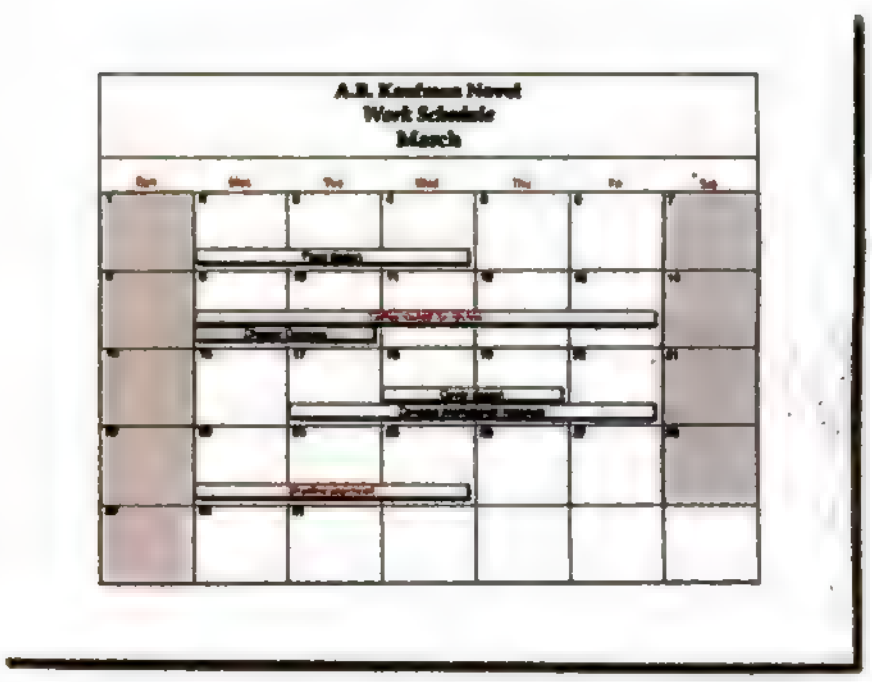
Through some additional research, however, we did find that IBM's server adapter may actually slow down a network. How much all depends on the baseline, but when tested against Madge Network's server adapter, for example, we found that the IBM device had 43 percent less throughput.

The test that we ran utilized the same software, PC, and server configurations as our throughput tests did, with a twist:

The CEO wants to know when it will be finished.



The staff wants to know when they can start.



As a project manager, you've seen it all before. Everyone who needs to know, all too often, needs to know something different. Which is why there's new Microsoft® Project version 3.0 for Windows.™

It not only makes it easy to present things the way *they* want, but also lets you plan things the way *you* want.

Now you can enter and view data in a variety of ways – Gantts, tables, graphs, forms and more. Microsoft Project also has a customizable Toolbar,™ giving you access

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We first ran the test with the same type of adapter in the server and the client PC. We then installed the IBM server adapter and retested. We did this across the product lines we reviewed, and found that the network consistently generated poorer throughput results with the IBM server adapter.

The 16/4 Adapter/A's documentation is skimpy and not too useful, and IBM provides only a one-year warranty. An extended service contract for the PS/2, however, covers the adapter.

Many customers probably value the 16/4 Adapter/A for reasons other than pure performance. IBM is one of the few vendors that can provide a complete line of Token-Ring products, from bridges and routers to multistation access units, printer-sharing units, and adapters for a slew of IBM platforms. What's more, IBM can provide the expertise needed to wrap all those elements up into a cohesive network.

The 16/4 Adapter/A is reliable and is backed by the largest company in the computer business. For those reasons alone, we recommend taking a careful look at this adapter for use in client machines, particularly if you don't mind rolling up your sleeves to optimize the system.

Lantana Technology Inc.

Lantana Cypress/2-16
Lantana Cypress/3-16

BY STEVE RIGNEY

Lantana Technology makes installation easy. You can configure the company's $625 16-bit Token-Ring adapter cards entirely with software, instead of searching through a maze of jumpers or DIP switches. The Lantana Cypress/2-16, an MCA adapter, and the Lantana Cypress/3-16, an ISA adapter, experienced performance and compatibility problems during our testing, however.

The Lantana Cypress package comes with drivers and configuration software for IBM LAN Server, IBM PC LAN Support, Novell's NetWare, and Microsoft LAN Manager. Using the configuration program to set up the adapter takes only a few minutes. You can change the adapter configuration without having to bother removing the machine's cover, unplugging the adapter, finding the right jumper or DIP switch, and plugging the adapter card back in.

Lantana also sells a $535 8-bit adapter

FACT FILE

Lantana Cypress/2-16

Lantana Cypress/3-16

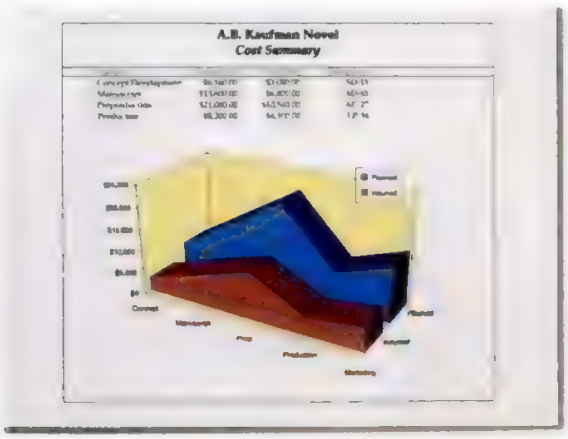
Lantana Technology Inc., 4393 Viewridge Ave., Suite A, San Diego, CA 92123; 800-666-4526, 619-565-6400; fax, 619-565-0798

List Price: $625 each

In Short: The Lantana Cypress/2-16 MCA and Cypress/3-16 ISA Token-Ring adapters are easy to install and you can configure them entirely by software. The products displayed some incompatibility and did not score well on our Token-Ring Throughput tests, however.

956 ON READER SERVICE CARD

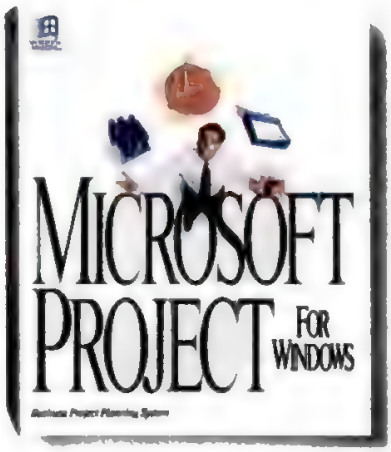
The controller wants to know how much it will cost.



to the functions you use most with a click of the mouse. While PlanningWizards give you online assistance to help develop plans.

What's more, new Microsoft Project has WYSIWYG and Multi-Page Print Preview, so plan on visiting the printer less.

We want to know what you're waiting for.



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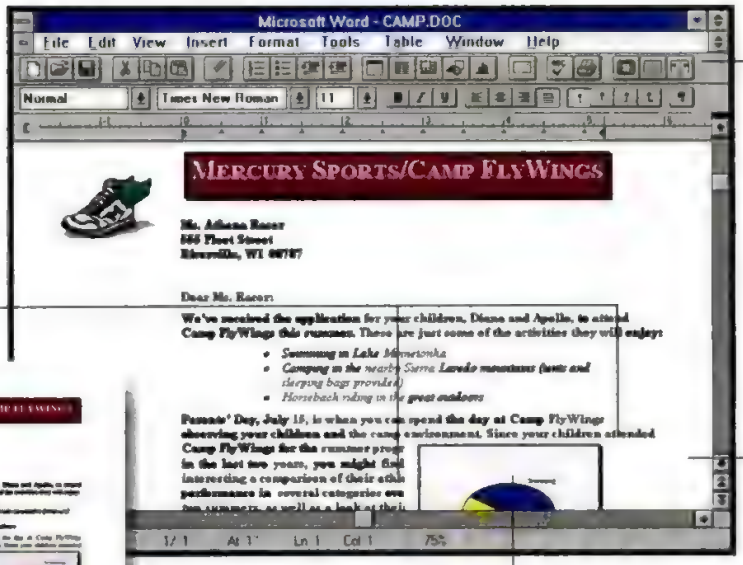
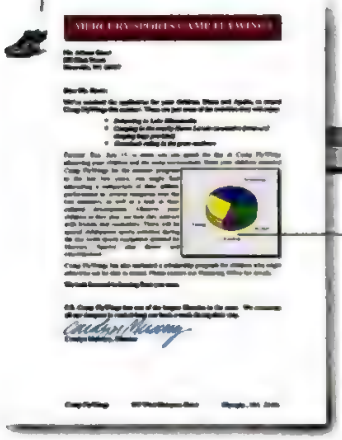
Their Word.

Microsoft Word 2.0

1

Don't take their word for it. Compare what you see on screen with what you get when you print. Notice, on screen, how some words are cut off and how the text runs beyond the margins. Now is that what you call WYSIWYG?





2

Want to circle a word in text or annotate your charts and graphs for added emphasis? Don't even try it in Word – because you can't.

3

What good are tools if they're inflexible? The Toolbar™ in Word sits on the top of your screen – on or off – those are your only options. And though you can change icons, you can't save sets of the ones you use most. And you certainly can't create your own icons.

4

Word has a Drag-and-Drop text editing feature. But that's about as far as it goes.

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Against Ours.

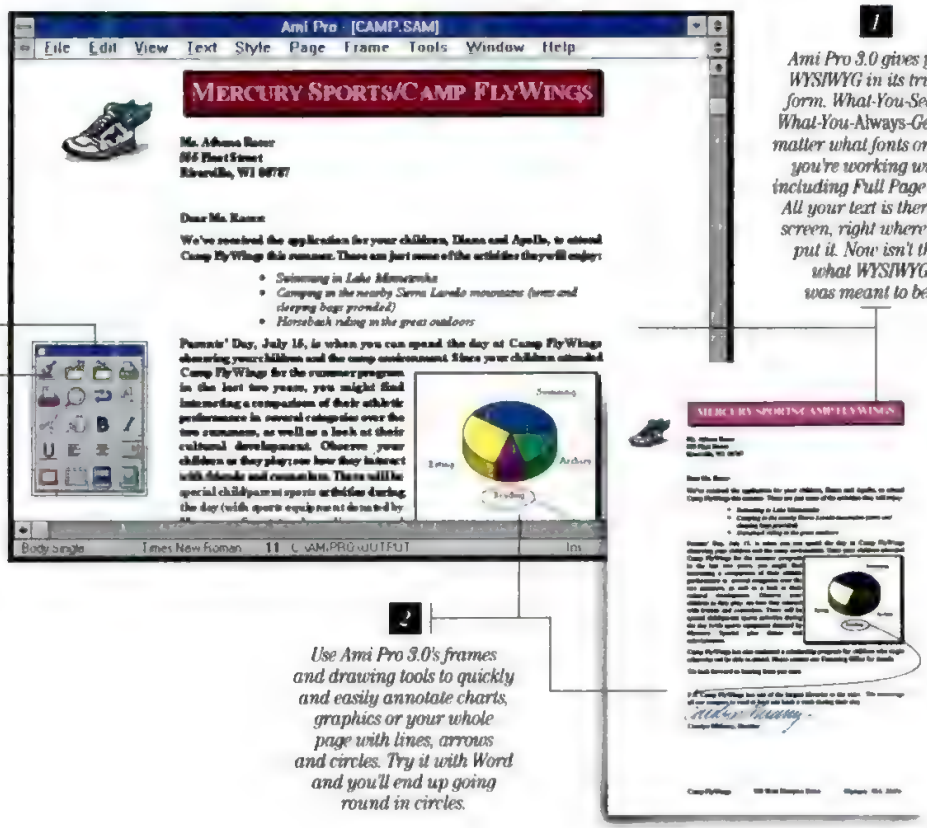
Lotus Ami Pro 3.0

3

Only Ami Pro 3.0 gives you colorful SmartIcons for one-click access to your most frequent tasks. And the freedom to customize, arrange or place them anywhere you choose. You can even create your own personal sets of SmartIcons based on the tools you need for certain tasks.

1

Ami Pro 3.0 gives you WYSIWYG in its truest form. What-You-See-Is-What-You-Always-Get, no matter what fonts or view you're working with, including Full Page view. All your text is there on screen, right where you put it. Now isn't that what WYSIWYG was meant to be?



4

Of course, Ami Pro 3.0 has Drag-and-Drop, too. But that's not all. Ami Pro 3.0 is the only word processor with Fast Format. So you can take the formatted attributes of a highlighted block of text and, with one quick click, apply those attributes to other text blocks.

2

Use Ami Pro 3.0's frames and drawing tools to quickly and easily annotate charts, graphics or your whole page with lines, arrows and circles. Try it with Word and you'll end up going round in circles.

There's no question about it. The new Lotus Ami Pro™ 3.0, the only word processor designed exclusively for Windows,™ is not only technically superior to Microsoft® Word. It's also much easier to learn and use.

Now if this comes as a surprise to you, or if you haven't yet considered Ami Pro, then you need to try it for yourself. Because once you do, you'll understand why *PC/Computing* (8/92) wrote that "Ami Pro 3.0 answers all the formidable challenges that Word for Windows 2.0 laid down and presents some new challenges for Microsoft to wrestle with."

Ami Pro 3.0 includes all the unique capabilities you see above. As well as a host of other easy-to-use features such as: a Style Sheet Viewer that lets you preview Style Sheets before selecting; SmartMerge™ that literally walks you through the different steps of completing a mail merge; a Clean Screen feature that lets you view only the tools you want to see on-screen to maximize workspace; a unique Context-sensitive Help system that's attached to each dialog box; and a QuickStart tutorial that gets you going in no time.

So don't take their word for it. Or even ours. You be the judge. If you're comparing word processors, order your free working model of Ami Pro 3.0 today by calling **1-800-872-3387, ext. 6961.** Or better still, upgrade from your current word processor* for just $129 and enjoy our new, free 24 hour support along with a 60-day money back guarantee.

Lotus Ami Pro 3.0 Word Processor for Windows

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(Note: Microsoft Word screen was created with Microsoft Word 2.0A using Windows 3.1. Ami Pro screen was created with Ami Pro 3.0 using Windows 3.1. Both were created using TrueType fonts at 75% view level.)

CIRCLE 040 ON READER SERVICE CARD

and multistation access units for shielded and unshielded twisted-pair media. The multistation access units range in price from $400 for a four-port unshielded twisted-pair model to $675 for an eight-port shielded twisted-pair multistation access unit.

The Cypress/2-16 fared better on our Network Throughput tests than did the 3-16, but both remained near the back of the pack. On the other hand, they both turned in excellent performance on the CPU Utilization tests. Both adapters worked at 412, 462, and the maximum length of 512 feet on the Cable Lobe Length tests.

ZD Labs' servers encountered several compatibility problems during the tests, however. The Cypress/2-16's port speed was too high for the PS/2 Model 90, while the Cypress/3-16 was not compatible with the Compaq Deskpro 483-33's CPU module version 2319.

Lantana solved both problems during our test period, and you can download new Model 90 drivers from Lantana's free BBS and get advice there for changing the Compaq's system configuration to fix the CPU problem.

Lantana's fine documentation explains each step of installation, and the company offers a limited lifetime warranty that covers parts and labor for any damages incurred during normal usage. Lantana has viable, but not outstanding, products, suitable for client personal computers as well as moderately loaded servers.

Madge Networks Inc.

Smart 16/4 AT Ringnode
Smart 16/4 EISA Ringnode
Smart 16/4 MC Ringnode

BY M. KEITH THOMPSON

The Smart 16/4 Ringnode line of Token-Ring adapters offers speed, flexibility, reliability, and advanced, self-configuring drivers. What's more, Madge offers drivers for just about every network, PC bus type, and operating system, but at price tags ranging from $945 to $1,295.

Madge offers a broad line of Token-Ring products, including bridges, multistation access units, controlled access units, and a network management software package called RingManager II. But Madge has made its greatest impact with network adapters.

We tested three of Madge's 16-bit adapters: the Smart 16/4 AT Ringnode, Smart 16/4 EISA Ringnode, and Smart 16/4 MC Ringnode, for ISA, EISA, and MCA machines, respectively. Madge also makes the Smart 16/4 PC Workstation Ringnode, a $795 8-bit adapter, for PCs, XTs, and ISA machines. Madge offers drivers for DOS, LANtastic, Microsoft LAN Manager, Novell's NetWare, OS/2, TCP/IP, Unix, and VINES with each adapter. Madge also has a Smart series of intelligent drivers for IBM LAN Server, Microsoft LAN Manager, and NetWare that load and find the network adapter in your PC, regardless of the adapter's settings. This convenience makes Madge's network adapters simple to use and manage.

The Smart 16/4 MC32 Ringnode, from Madge Networks, is the first Token-Ring adapter card to take advantage of Micro Channel's streaming mode in transferring data.

All Ringnode adapters include connectors for shielded and unshielded twisted-pair cable, as well as 128K of RAM on-board (except the 16/4 EISA, which has 256K). Madge also markets reprogrammable boot ROMs for LAN Manager and NetWare, allowing you to boot up a diskless LANstation from the network.

The 16/4 MC32 Ringnode, $1,295, which we received too late for performance testing, is a full 32-bit bus-mastering Micro Channel adapter, with 32-bit addressing and 32-bit data paths. Some cards provide a 32-bit bus, but cannot perform 32-bit DMA (direct memory access) transfers.

The 16/4 MC32 is the first Token-Ring adapter to take advantage of Micro Channel's streaming mode, allowing it to transfer data from the Token-Ring to the computer, theoretically, at 40 megabytes per second; normal MCA adapters transfer data at 4 to 6 megabytes per second.

The 16/4 EISA Ringnode provided the most throughput among the EISA adapters. Madge's 16/4 AT and MC cards scored at or near the top of our ISA and MCA throughput charts for one adapter, along with Olicom's and Proteon's adapters. Madge's 16/4 MC, however, had the lowest throughput among the MCA cards in the three-adapter configuration. The 16/4 EISA Ringnode ranked with Proteon's EISA card on CPU utilization, beating out Olicom by a wide margin. But the 16/4 AT's CPU utilization score was the poorest of its group. The 16/4 MC also showed excessive CPU utilization, but this decreased when larger blocks were used. The performance index of 5.01 for the 16/4 EISA was the highest among EISA cards for the 4K-packet, one-adapter configuration. The 16/4 AT scored a below-average 1.30 and the 16/4 MC rated a low 2.24 for the same configuration, however. For the 4K-packet, two-adapter configuration, the 16/4 EISA scored just behind Proteon's EISA adapter on the Performance Index, and it gained the highest P.I. in the 4K-packet, three-adapter setup. But of the

FACT FILE

PC MAGAZINE EDITORS' CHOICE

Smart 16/4 AT Ringnode

Smart 16/4 EISA Ringnode

Smart 16/4 MC Ringnode

Madge Networks Inc., 42 Airport Pkwy., San Jose, CA 95110-1009; 800-876-2343, 408-441-1300; fax, 408-441-1335

List Price: Smart 16/4 AT Ringnode, $945; Smart 16/4 EISA Ringnode, $1,295; Smart 16/4 MC Ringnode, $945.

In Short: The Madge Ringnode line of Token-Ring adapters turned in some of the fastest numbers among our test products and comes with a wide variety of software drivers, including several that are self-configuring. Madge markets an adapter for each type of PC bus and sells its adapters at the top of the price scale. Madge's Smart 16/4 Ringnode line also features the Smart 16/4 PC Workstation Ringnode, an 8-bit adapter for PCs, XTs, and ISA machines, priced at $795.

957 ON READER SERVICE CARD

five MCA adapters tested in the two- and three-adapter configurations in the server, the 16/4 MC had the lowest P.I. in both setups. The ISA and EISA Ringnode cards successfully transferred data at the maximum distance of 512 feet on the Cable Lobe Length tests, but the MCA card worked only as far as 462 feet.

All adapters in the Ringnode line use the same software, and Madge conveniently prints the switch setting on the adapter, so you don't have to refer to the manual. If you do need to look at the excellent Ringnode documentation, it is thorough and helpful.

Madge offers a money-back guarantee and five-year warranty. If a problem cannot be resolved via its toll-free number, Madge sends a technician on-site.

If you're looking for high-performance Token-Ring adapters, Madge likely has the solution for you. The company's extensive support for drivers and operating systems makes the Ringnode line a strong corporate platform. Madge's EISA and MC Ringnodes are strong server cards, while the AT Ringnode should perform well as a high-performance adapter for client PCs.

Olicom USA Inc.

Olicom 16/4 EISA Adapter
Olicom 16/4 ISA Adapter
Olicom 16/4 MCA Adapter

BY M. KEITH THOMPSON

Bus-mastering adapter cards are supposed to be perfect for file servers because of their blazing speed and, more important, great scalability (or, ability to handle multiple adapters). Olicom USA's adapters hit the first mark. The company's 16-bit ISA, EISA, and MCA adapters, which are priced from $895 to $950, screamed through our throughput tests. But the Olicom EISA adapter's high CPU utilization brought our server to its knees.

Why? Despite Olicom's advertising, its EISA card isn't a bus-mastering adapter. It actually implements programmed I/O and DMA (direct memory access) to move data between adapter and PC, hence the high overhead. Still, if you're looking for a line of fast client adapters for ISA, EISA, and MCA machines with drivers for virtually every operating environment at a fair price, Olicom's line of adapter cards deserves a long, hard look.

Olicom's adapters receive high marks for fast throughput, ease of use, and solid construction. But the EISA card makes heavy demands on the CPU.

Olicom provides a complete set of drivers, making installation easy for administrators of Banyan's VINES, IBM LAN Server, Novell's NetWare, or Microsoft LAN Manager. Although the drivers don't have the self-configuration features of Madge's Smart drivers, the documentation is good enough to make installation simple. And NetWare options are plentiful: For clients, Olicom provides DOS and OS/2 ODI drivers in addition to traditional IPX drivers. For file servers, Olicom offers drivers for NetWare 2.2, 3.0, and 3.1.

FACT FILE

Olicom 16/4 EISA Adapter

Olicom 16/4 ISA Adapter

Olicom 16/4 MCA Adapter

Olicom USA Inc., 900 East Park Blvd., #180, Plano, TX 75074; 214-423-7560; fax, 214-423-7261.

List Price: Olicom 16/4 EISA Adapter, $950. Olicom 16/4 ISA Adapter, $895. Olicom 16/4 MCA Adapter, $895

In Short: Olicom's line of adapters provides excellent throughput, ease of use, and support for a vast number of drivers. The EISA adapter isn't the best choice for file servers connecting many segments, but they are all good choices for small companies. Olicom also makes the Olicom 16/4 PCA Adapter, an 8-bit adapter for ISA machines, for $695

550 ON READER SERVICE CARD

Olicom also markets an optional $85 boot ROM for NetWare, allowing computers without disk drives to access the network. Olicom's cards come with 128K of RAM. Olicom also makes bridges, hubs, repeaters, and a 16/4 converter.

On our throughput tests, Olicom's cards finished at or near the top. The 16/4 MCA rated first in two of the Micro Channel tests, while the 16/4 ISA finished near the top of the charts. The 16/4 EISA was second to Madge's Smart 16/4 EISA Ringnode in two of the EISA tests. But because the product does not use a bus-master design, server CPU utilization jumped to 71.72 percent for the 16/4 EISA on the 1-adapter, 4K-packet test, compared with 19.18 percent for Madge's Smart 16/4 EISA. With two adapters, the Olicom 16/4 EISA reached 96.97 percent, and with three adapters, it went as high as 99.99 percent, compared with Madge's 36.86 and 55.98 percent with the same respective configurations. This effectively limits the 16/4 EISA to only one adapter per server. With one adapter, the 16/4 EISA had the lowest performance index at 1.26, the 16/4 ISA a fairly high 1.51, and the 16/4 MCA a respectable 2.88. Olicom's adapters all passed the Cable Lobe Length test at the maximum 512 feet.

Olicom offers a three-year warranty and good documentation, complete with charts, diagrams, and a large section on error messages. Olicom's Token-Ring adapters receive high marks for fast throughput, ease of use, and good construction. But the 16/4 EISA's throughput will drop severely when you put multiple adapters in the server. We recommend Olicom's EISA board only for light-duty, single-segment servers. All of the adapters should function just fine as client PC cards.

Proteon Technology Corp.

Proteon ProNET-4/16 P1392
Proteon ProNET-4/16 P1892
Proteon ProNET-4/16 P1990

BY M. KEITH THOMPSON

Despite the high-performance design of Proteon Technology Corp.'s ProNET-4/16 line of adapter cards, the devices did not always produce the best results on our series of benchmark tests. The company has a good reputation in the Token-Ring marketplace, however, and offers a reliable product. Proteon's pricing ranges from $795 for the P1392 ISA model and the P1892 Micro Channel adapter to $995 for the P1990 EISA unit.

Proteon Technology's ProNET-4/16 series of adapter cards uses well-designed bus-master technology instead of the conventional I/O or shared RAM designs.

The driver disk for the Proteon products offers server drivers for NetWare 2.15c, 2.2, and 3.11, and SCO Unix. For client adapters, Proteon supplies IPX drivers for DOS, ODI drivers for DOS and OS/2, NDIS drivers for DOS and OS/2, VINES drivers, and the IBM LAN Requester for IBM PC LAN. The adapters work well and install easily in IBM LAN Server 1.3 and 2.0 environments. The ProNET series of adapters uses well-designed bus-master technology instead of the conventional I/O or shared RAM designs. The adapter cards provide connections for shielded and unshielded twisted-pair cable and offer 128K of RAM on-board.

Proteon's adapters turned in mixed performance throughout our tests. The ProNET-4/16 P1990 had the poorest results among our reviewed products on two of our Network Throughput tests, while the ProNET-4/16 P1392 and P1892 ran near the middle of the pack for MCA and ISA bus adapters. The ProNET-4/16 P1990 performed well on the CPU Utilization tests, taking first place for the one-, two-, and three-adapter, 4K-packet configurations.

In the Performance Index, the ProNET adapters received midrange scores: 1.39 for its ISA adapter, 4.63 for its EISA device, and 2.79 for the MCA unit (all scores for the 1-adapter, 4K-packet configuration). Proteon's EISA card achieved the highest Performance Index in the two-adapter configuration. The other Proteon cards got midrange P.I. ratings in the multiple-adapter configurations. Each of the ProNET adapters was able to communicate at 512 feet, the maximum distance in our Cable Lobe Length tests.

The adapters come with detailed, well-illustrated documentation that features charts and diagrams, step-by-step instructions, a troubleshooting section, and a complete error-message description. The adapters are backed by a lifetime warranty. Proteon's Token-Ring line also includes bridges, routers, and passive and active hubs. The ProNET series is cost-competitive and dependable.

FACT FILE

Proteon ProNET-4/16 P1392

Proteon ProNET-4/16 P1892

Proteon ProNET-4/16 P1990

Proteon Technology Corp., Two Technology Dr., Westborough, MA 01581; 800-545-7464, 508-898-2800; fax, 508-366-7930

List Price: Proteon ProNET-4/16 P1392, $795; Proteon ProNET/4-16 P1892, $795; Proteon ProNET/4-16 P1990, $995.

In Short: Proteon has a reputation for providing a quality product at a competitive price. Its ProNET line offers a reliable set of adapters, but with only average performance. The adapters offer a well-engineered bus-mastering design.

559 ON READER SERVICE CARD

Thomas-Conrad Corp.

Thomas-Conrad TC4045
Thomas-Conrad TC4046

BY PADRAIC R. BOYLE

Need a network connection for your client or server? Thomas-Conrad Corp. offers two: the TC4045, an ISA adapter, and the TC4046, an MCA adapter. Both 16-bit adapter cards, priced at $795 and $750 respectively, offer performance that was very competitive among the adapter cards we tested.

The cards use either bus-mastering

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CIRCLE 366 ON READER SERVICE CARD

FACT FILE

Thomas-Conrad TC4045

Thomas-Conrad TC4046

Thomas-Conrad Corp., 1908-R Kramer Ln., Austin, TX 78758; 800-332-8683, 512-654-1935; fax, 512-836-2840

PC MAGAZINE EDITORS' CHOICE

List Price: Thomas-Conrad TC4045, $795; Thomas-Conrad TC4046, $750.

In Short: Thomas-Conrad's Token-Ring adapter line, the TC4045 for ISA and the TC4046 for MCA machines, performed well on our benchmark tests. High throughput, a moderate price, and easy installation make them good Token-Ring solutions.

500 ON READER SERVICE CARD

or—if you disable bus-mastering—shared memory. They can attach to either shielded twisted-pair (Type 1) or unshielded twisted-pair (Type 3) networks, and both support Artisoft's LANtastic, Banyan's VINES, IBM LAN Server, Microsoft LAN Manager and its derivatives, Novell's NetWare, and Performance Technology's POWERLan.

Additional drivers compatible with LLC/AHI (Logical Link Control/Adapter Handling Interface) networks—IBM PC LAN for example—are also available free from Thomas-Conrad. Both adapters offer 128K of on-board memory, and upgrades to 1MB and 2MB are available.

The TC4045 and TC4046 are fairly easy to install, but you need to set switches and jumpers on the TC4045. Thomas-Conrad simplifies this process with its Ring Tool diagnostic program, which displays the correct jumper and switch settings for the adapter. The two adapters are part of a Token-Ring line that includes multistation access units and Sectra, a Token-Ring management software package.

High throughput and low CPU utilization put the Thomas-Conrad adapters among the top performers on our benchmark tests. The Thomas-Conrad TC4045 had the highest Performance Index rating on the 512-byte packet test. Both adapters functioned smoothly at 412, 462, and the maximum tested length of 512 feet on our Cable Lobe Length tests.

High throughput and low CPU utilization put Thomas-Conrad's adapters among the top performers.

The clear and well-written documentation from Thomas-Conrad contains plenty of examples. A two-year warranty covers all its products, and you can call for free technical support over a toll-free, 24-hour phone number seven days a week. Additional technical support and up-to-date LAN drivers are available on CompuServe and Thomas-Conrad's bulletin board service.

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Programming

UTILITIES

The Bugs You'll Want to Keep In Your Windows 3.1 Setup

BY DOUGLAS BOLING

Look around today's offices and you'll probably see a constantly changing screen-saver display on the monitor at every unoccupied desk. Once needed to prevent burning in a C:\> prompt on an unattended monochrome monitor—or to provide a minimal level of security by blanking the display—screen savers have become popular in their own right.

I couldn't resist the trend, so this issue's utility is a screen saver called BUGS. BUGS creates voracious little "bugs" that gradually eat away the display on your screen whenever the monitor is left idle for more than a few minutes. As with other screen savers, you can instantly restore your normal display with any keystroke or mouse movement. Note that since it takes a little time before BUGS covers the display entirely, you'll want to use a different screen saver if you need instant blanking for security reasons. Note, too, that BUGS only works with Version 3.1 of Microsoft Windows.

You can download BUGS.SCR from Library 2 (PCMag Utils) of the Utilities/Tips Forum on PC MagNet by following the instructions in the sidebar "Utilities by Modem." If you also want the C source code and the necessary include and resource files, you should download BUGS.ZIP. To make use of the code, you'll need either the Windows SDK (Software Development Kit) and Microsoft C 6.0, or Borland's C++ 3.0 compiler. To compile using C 6.0, the command is

```
NMAKE BUGSMSC.MAK
```

To compile with C++ 3.0, enter

```
MAKE -f BUGSBC.MAK
```

If you don't have a modem, you can get both the executable and source code directly from *PC Magazine*. Just send a postcard with your name, address, and preferred disk size to the attention of Katherine West, *PC Magazine*, One Park Ave., New York, NY 10016. No phone calls please.

BREEDING BUGS To install the program, just copy BUGS.SCR into your Windows directory (or into the directory that contains CONTROL.EXE). To select BUGS as your screen saver, open the Control Panel and double-click on the Desktop. Pull down the Screen Saver combo box that contains the list of screen savers installed on your machine and pick the one titled Hungry Bugs.

Here's a screen saver that will devour your display, and a set of routines so you can write your own screen saver.

Like the other Windows 3.1 screen savers, BUGS can be configured and tested from the Desktop configuration dialog box. By pressing the Screen Saver Setup button, you can modify the basic parameters that affect the life of a typical bug. The OK and Cancel buttons close the dialog box, with only OK saving the changes you have made.

A short course in basic bug biology will help you understand the configuration options, which are pictured in Figure 1. Each pixel has a specific *nutritional value* based on its color. If a bug ingests a bright red pixel, for example, it takes in 255 calories, since the pixel has an RGB value of Red 255 + Green 0 + Blue 0. The calorie count for a white pixel is 765 (RGB = 255 + 255 + 255). To add a touch of variety, the three sliders in the nutrition level section of the Setup dialog box let you vary the relative nutritional values of the different colors.

When a bug eats a pixel, the pixel turns black and the bug moves on, seeking further nourishment. Movement requires energy, however, so each time a bug moves, a *sustenance value* is subtracted from that bug's caloric reserve. Thus, if you set the sustenance value to 64, 64 calories will be subtracted from a bug's energy stock each time the bug makes a turn. Naturally, if the value of a bug's food units falls below zero, it dies of starvation. Setting a high sustenance value causes bugs to starve quickly after they are born, while reducing this value permits bugs to survive on very few dimly colored pixels.

When a bug eats enough pixels to reach the *reproduction level* set by the user, a new bug is born automatically. By setting this level low you can cause something of a population explosion; setting a high level as a requirement for reproduction will keep only a select few bugs wandering the screen. Each newborn bug has enough calories to sustain itself for at least a few turns before it finds any food. The birth of the baby reduces its

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Utilities by Modem

The *PC Magazine* utilities are available by modem from PC MagNet, a ZiffNet service hosted by CompuServe.

To find the phone number nearest you, set your communications software to 300, 1,200, 2,400, or 9,600 bits per second, 7 data bits, even parity, 1 stop bit, and full duplex, then dial 800-346-3247 with your modem. When the modem connects, press Enter. At the HOST NAME prompt, enter PHONES. Follow the menus and note the number closest to you. Or you can call 800-635-6225 (voice) and follow the instructions and note the number.

To obtain the current issue's utility *free of charge*, dial the local number; at the HOST NAME prompt, type CIS; at the USER ID prompt, enter 60116,1. And then at the PASSWORD prompt, enter PCMAG-UTIL.

To join ZiffNet: At the USER ID prompt, type 177000,5000. Then, at the PASSWORD prompt, enter PC* MAGNET. And finally, at the ENTER AGREEMENT NUMBER prompt, type PCMAG92.

Register your name and enter your MasterCard, Visa, or American Express card number. (If you'd like to have your company billed instead, call CompuServe at 800-848-8990.) Your personal user ID and a temporary password will be displayed. A new password will arrive in the mail within 10 days to confirm your subscription.

ZiffNet membership costs $2.50 per month. This includes access to PC Magazine Editors' Choice Awards, Product Reviews index, Weekly News from *PC Week*, Buyers's Market, ZiffNet Highlights, and the Support Forum (which also includes the current utility). CompuServe members can join by entering GO PCMAG at any CompuServe ! prompt.

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parent's food reserve by half.

When BUGS starts, one bug is generated at a random location on the screen. This bug immediately begins to eat away at the display and quickly reaches its reproduction level, whereupon it reproduces. The second bug acts just like the first, eating pixels and giving birth to other bugs. Within a second, anywhere from tens to hundreds of bugs will have been spawned in the vicinity of the initial insect.

To inject a touch of biospheric variety, some bugs have slightly different tasks. Thus, 10 percent of the bugs are programmed to be best at finding bright pixels. These bugs serve as scouts. Scout bugs don't wander randomly, but tend rather to move in the direction that provides the best food. If moving up the screen provides a scout bug with a good meal, its next move will more than likely be up. These scout bugs help prevent a boring herd of bugs clustering around the initial bug.

Calculating the next move for hundreds of bugs is a time-consuming task, so the Setup box lets you limit the maximum number of bugs. A fast 486 with a graphics accelerator card can support up to 1,000 bugs without trouble. For slower machines, 200 or 300 bugs is the recommended maximum. BUGS will still work if you set the limit higher, but the program will slow down.

As a final customization option, color boxes can be checked that show you how the bugs are performing. When you enable colorization for new baby bugs, they shown up as green pixels. When you enable colorization for dead bugs, they are shown as red pixels.

Modifying the sustenance and reproduction level controls can easily produce excessive results. Since it's possible to create an environment in which all the bugs starve before reproducing, or, conversely, to bog down the program by overpopulation, BUGS contains two checks on the environment. If all the bugs die off, a new seed bug is randomly placed somewhere on the screen. This repopulation allows the program to blank the screen eventually no matter what parameters you set. When repopulation takes place, the sustenance value is automatically lowered by 10 percent, making the new bugs tougher than their recently deceased predecessors.

To curb overpopulation, the ranks of the bugs are culled if their number rises to within 80 percent of the maximum number of bugs allowed. (After all, in an overpopulated environment, predators will soon learn about such a rich food source.) Trimming the bug population takes place every 15 seconds, with the least productive 20 percent of the bugs being killed off.

HOW BUGS WORKS The screen-saver modules (.SCR files) used by the Windows 3.1 screen-saver program are really nothing more than standard Windows applications with a few special features. For starters, the modules must have an .SCR extension. Second, the description line inside them must follow a specific format. And third, the screen-saver module must respond to a specific command line parameter.

When opened, the Desktop control panel applet checks its directory for all files with an .SCR extension. Each .SCR file is opened and the description line is read. (This line is inserted by the linker when the program is created.) If the description line contains the opening text `SCRNSAVE :` then the file is considered a screen-saver module.

The desktop applet takes the text that immediately follows the `SCRNSAVE :` and places it in the drop-down combo box that lists the available screen-saver modules. Thus, since BUGS contains the description `SCRNSAVE : Hungry Bugs` the desktop applet puts the title "Hungry Bugs" in the combo box, along with the standard modules such as Mystify, Marquee, and Flying Windows.

When the user selects a screen saver and presses the Setup button, the Desktop applet uses the standard WinExec function to run the screen-saver module. The module is responsible for displaying a Setup dialog box, interacting with the user, and saving the new configuration.

The configuration for each screen saver is kept in the CONTROL.INI file, in a section called [Screen Saver.*xxx*], where *xxx* is the screen saver's name. Thus, BUGS stores its configuration in a [Screen Saver.Bugs] section. Each screen saver is responsible for reading and writing its own configuration.

When the user presses the Test button, the Desktop applet runs the screen-saver module with a -S (or a /S or just S) command line parameter. The screen saver must recognize this command line parameter so that instead of displaying the Setup dialog box it starts the actual screen-saver routine.

***Figure 1:* The Hungry Bugs screen saver's Setup dialog box is where you choose the bugs' characteristics.**

SCREEN SAVER LIBRARY MODULE To help developers write Windows 3.1 screen savers, Microsoft has included a static library (SCRNSAVE.LIB) in the Windows 3.1 SDK. This library of routines allows a programmer simply to link in the routines required for screen savers. The static library includes routines for WinMain (a default screen-saver window procedure) and a set of routines used for password protection.

This static link approach is strangely contrary to the extremely flexible dynamic linking approach used elsewhere in Windows. Moreover, since the SCRNSAVE library files are not distributed with Windows, programmers would have to buy the SDK or some other programming product that provides the routines.

Fortunately for programmers who lack 3.1 development tools, most of the functions in SCRNSAVE are simple and easily duplicated. Thus, it is not necessary for you to have the SCRNSAVE library in order to write a screen-saver module. In fact, after describing the BUGS.SCR, which was written to make use of Microsoft's SCRNSAVE.LIB, I'll discuss an alternative BUGSBC.SCR, which was written to get along without SCRNSAVE. Files for both versions are available for downloading.

USING THE SCRNSAVE LIBRARY Why would you want to use the SCRNSAVE library if it's easy enough to write a screen-saver module that incorporates the special features outlined above without relying on SCRNSAVE.LIB? For one thing, of course, it does save you the trouble of having to write a number of routines. A more important reason, however, is that the password feature of the Windows 3.1 screen saver requires a proprietary encoding routine that is found only in SCRNSAVE.LIB. Without the SCRNSAVE password routines, there is no way for a screen saver to read or write the password that is used by the other Windows screen-saver modules.

Using the SCRNSAVE library presents its own problems, however, for it is rather clumsily tacked onto the other parts of the screen-saver module. The library requires the developer to use a block of predefined global variables and to make additions to the resource file. Further, the screen-saver routines and dialog boxes require the developer to use predefined names.

The block of global variables programmers must use with the SCRNSAVE library can only be found in the BOUNCER example screen saver that comes with the SDK. The variables themselves are arbitrarily named and useless to the rest of the screen saver; nonetheless, they must be included in order to link SCRNSAVE.LIB without errors.

The resource file for the screen saver must also include a block of String resources that the programmer must use to initialize the global variables. As with the global variables, these resource strings are not documented anywhere, but they do appear in the BOUNCER example. The SCRNSAVE library requires these resource strings to determine information about the screen saver such as its name and password protection status.

Writing a screen saver using the static library requires that the screen-saver code contain three routines: ScreenSaverProc, ScreenSaverConfigureDialog, and RegisterDialogClasses. As you'd deduce from the names, ScreenSaverProc is the window procedure, and ScreenSaverConfigureDialog is the dialog procedure for the Setup dialog box. Both these routines must be exported using the EXPORTS section in the .DEF file. RegisterDialogClasses is used to register any necessary window classes before the Setup dialog box is displayed. This routine should not be exported.

The ScreenSaverProc shown in Figure 2 provides the basic function of the screen saver. It is constructed like any other window procedure, and it must respond to the standard set of window messages. Unlike a standard window, however, the screen-saver window is not confined to a small client window; it's the entire desktop. Any messages not processed by ScreenSaverProc should be passed on to DefScreenSaverProc, another routine in the static library. DefScreenSaverProc is responsible for monitoring the keyboard and mouse as well as for blanking the cursor and displaying the password query box (if implemented).

ScreenSaverConfigureDialog, shown in Figure 3, provides the code for the Setup dialog box. The routine must read the current configuration from CONTROL.INI to set the initial state of the dialog box controls. It must also respond to any messages from the controls and save the new settings if the user presses the OK button. ScreenSaverConfigureDialog is like any other Windows dialog box procedure, the name being the only requirement imposed by the SCRNSAVE library. The layout of the Setup dialog box and its actions are up to you.

The RegisterDialogClasses procedure shown in Figure 4 is called before the Setup dialog box is displayed so that the screen saver has a chance to register any special window classes needed for the dialog box. (Such special window classes would be required if the Setup dialog used any custom controls or special windows.) If the registration is successful or if there are not window classes to register, the routine should return TRUE; other-

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S=V1C4

ScreenSaverProc

```
//=================================================================
//ScreenSaverProc - The Window procedure
//=================================================================
LONG FAR PASCAL ScreenSaverProc(HWND hwnd, WORD msg, WORD wParam,
                                LONG lParam) {
    static  HWND    hwndDesktop;
    static  int sScreenCx, sScreenCy;
    static  WORD    wTimer;
    static  WORD    wTimer1;

    HDC     hdc;
    int     i, j;

    switch(msg) {
        case WM_CREATE:
            hwndDesktop = GetDesktopWindow();

            GetStrings();
            GetProfile();

            hdc = GetDC (hwndDesktop);
            sScreenCx = GetDeviceCaps (hdc, HORZRES);
            sScreenCy = GetDeviceCaps (hdc, VERTRES);
            ReleaseDC (hwndDesktop, hdc);

            srand (LOWORD (GetCurrentTime()));
            sScoutLimit = sBugLimit / 10;
            if (sSustenance > 100)
                sSustenance += sSustenance/100;
            else
                sSustenance++;

            PostMessage (hwnd, WM_USER, 0, 0);

            //-----------------------------------------------------------
            //Use timer 1 if BugSmarts routine is called from WM_TIMER
            //instead of from the message loop.
            //-----------------------------------------------------------
            wTimer = SetTimer (hwnd, 1, 100, NULL);
            //
            //Timer 2 used for population ctl
            //
            wTimer1 = SetTimer (hwnd, 2, 15000, NULL);
            break;


        case WM_USER:
            //
            // WM_USER message used to reseed bug population
            //
            hdc = GetDC (hwnd);
            for (i = 0; i < 6; i++)
                for (j = 0; j < 6; j++)
                    SetPixel (hdc, i, j, 0x000000);

            if (sSustenance > 100)
                sSustenance -= (sSustenance/100);
            else
                if (sSustenance > 0) sSustenance--;

            sNumBugs = 1;
            //
            //10 trys to find a non black pixel
            //
            for (i = 0; i < 10; i++) {
                baBugArray[0].PosX = (sScreenCx / 100) * (rand() % 100)+50;
                baBugArray[0].PosY = (sScreenCy / 100) * (rand() % 100)+50;
                if (GetPixel (hdc, baBugArray[0].PosX, baBugArray[0].PosY))
                    break;
            }
            baBugArray[0].wXVec = rand() % 3;
            baBugArray[0].wYVec = rand() % 3;
            baBugArray[0].lFood = sSustenance * 20;
            baBugArray[0].dwColor = 0x00000000;

            ReleaseDC (hwnd, hdc);
            break;

        case WM_TIMER:
            //-----------------------------------------------------------
            //Use two timers if BugSmarts called from timer routine
            //-----------------------------------------------------------
            if (wParam == 1) {
                        BugSmarts(hwnd);
                    } else {
                        if (sNumBugs > (sBugLimit/5) * 4) {
                            qsort (baBugArray, sNumBugs,
                            sizeof(BUGSTRUCT), BugCmp);
                            sNumBugs -= (sNumBugs / 5);
                        }
                    }
                    break;

            case WM_ERASEBKGND:
                //
                // We don't want the background erased
                //
                return 0;

            case WM_DESTROY:

                //-----------------------------------------------------------
                //Use timer 1 if BugSmarts routine is called from WM_TIMER
                //instead of from the message loop.
                //-----------------------------------------------------------
                if (wTimer) KillTimer(hwnd, 1);
                if (wTimer1) KillTimer(hwnd, 2);
                break;
        }
        return DefScreenSaverProc(hwnd, msg, wParam, lParam);
}
```

Figure 2: **When using the Microsoft SCRNSAVE library, ScreenSaverProc is the main routine used by BUGS.SCR.**

wise, the routine should indicate a failure by returning FALSE.

Three additional routines must be considered for screen savers that implement password protection: DlgChangePassword, DlgGetPassword, and DlgInvalidPassword. All three are provided by the SCRNSAVE.LIB, so the only programming requirement is that they be exported in the .DEF file. The SCRNSAVE routines encode the password before it is stored in CONTROL.INI and ensure that the same password works with all screen-saver modules. To me, the password protection provided in SCRN SAVE.LIB is its best feature.

The SCRNSAVE library also requires the inclusion of a block of string resources in the resource file. The string idsAppName must contain the heading used in the CONTROL.INI file. Thus, since BUGS saves all its configuration information under the heading Screen Saver.Bugs, the idsAppName resource in BUGS is also defined as Screen Saver.Bugs. Other strings are also required: idsIsPassword must be set to the flag in the CONTROL.INI file that indicates whether a password is required, and the string "control.ini" must be assigned to idsIniFile.

In addition to using the resource strings required by SCRNSAVE, the resource file must use predefined names for dialog boxes and icons. The first icon specified in the resource file must have the identifier ID_APP. This particular icon is used as the icon for the executable program. The Setup dialog box template must also be labeled DLG_SCRNSAVE-CONFIGURE.

Again, if the screen saver is to implement password protection, three other dialog box templates must be provided. These templates, DLG_CHANGE-PASSWORD, DLG_ENTERPASS-WORD, and DLG_INVALIDPASS-WORD, are used by the routines DlgChangePassword, DlgGetPassword, and DlgInvalidPassword, respectively. Since the routines that control these password dialog boxes are embedded in the SCRNSAVE library, these templates must use a predefined set of controls and control IDs. Suggested templates for these password dialog boxes are provided in the Screen Saver Overview section of the SDK help file.

From what I've said, you can probably understand why writing a screen saver using the SCRNSAVE library is like wrestling with an octopus: Its tentacles seem to reach everywhere you try to turn. The necessity of the global variables, their strange initialization, and the demands for specific routine names make for a more complex program. If you want 100 percent Microsoft screen-saver compatibility, however, SCRNSAVE is the way to go.

GETTING ALONG WITHOUT SCRNSAVE

Since not everyone will have the 3.1 de-

velopment tools, I have included a package of routines that duplicate all but the password functions of SCRNSAVE.LIB. They are in the files PCSCRLIB.C and PCSCRLIB.H. My routines assume the same procedure names as SCRNSAVE so that your code can be easily migrated to SCRNSAVE if that should ever become necessary.

The include files for my screen-saver routines include a WinMain routine and include files to replace the includes needed by the SCRNSAVE routines. The WinMain routine parses the command line and either creates a screen-saver window or displays the Setup dialog box. As with SCRNSAVE, my WinMain calls the RegisterDialogClasses routine to allow the screen-saver code to register any special window classes.

My default screen-saver procedure implements the standard functions required by a screen saver. When the screen-saver window is created, the cursor is hidden and the current position of the mouse is stored. From then on, any WM_CHAR or WM_MOUSEMOVE messages cause the program to terminate. Any messages not parsed by the default screen-saver procedure are passed to the window's DefWindowProc.

THE BUGS THEMSELVES Ignoring the special screen-saver requirements, the way the bugs themselves are handled in the program calls for some comment. Each bug has its own life, so each must be processed individually. The state of all bugs on the screen is kept in an array of structures. Each structure contains the position, current direction, and food content of a single bug. The main work of the BUGS screen saver is to process this array continually, in this way providing a life for each bug in the array. The array is processed as fast as Windows allows.

ScreenSaverConfigureDialog

1 of 2

```
//=====================================================================
//ScreenSaverConfigureDialog - Dialog procedure for configure dialog box
//=====================================================================


BOOL FAR PASCAL ScreenSaverConfigureDialog(HWND hDlg, WORD msg, WORD wParam,
                                           LONG lParam) {

    int i, j;

    char    szTemp[10];


    switch (msg) {
        case WM_INITDIALOG:

            GetStrings();


            GetProfile();

            SetText (hDlg, IDD_REDTEXT, wRNutrition, "Red: ");
            SetText (hDlg, IDD_GREENTEXT, wGNutrition, "Green: ");
            SetText (hDlg, IDD_BLUETEXT, wBNutrition, "Blue: ");
            SetText (hDlg, IDD_MAXBTEXT, sBugLimit, "Max Number of Bugs: ");
            SetText (hDlg, IDD_BIRTHTEXT, sBabyLevel, "Reproduction Level: ");
            SetText (hDlg, IDD_SUSTEXT, sSustenance, "Sustenance Level: ");


            SetScrollRange (GetDlgItem (hDlg, IDD_REDLEVEL),
                            SB_CTL, 0, 10, FALSE);

            SetScrollPos (GetDlgItem (hDlg, IDD_REDLEVEL),
                          SB_CTL, wRNutrition, TRUE);


            SetScrollRange (GetDlgItem (hDlg, IDD_GREENLEVEL),
                            SB_CTL, 0, 10, FALSE);

            SetScrollPos (GetDlgItem (hDlg, IDD_GREENLEVEL),
                          SB_CTL, wGNutrition, TRUE);


            SetScrollRange (GetDlgItem (hDlg, IDD_BLUELEVEL),
                            SB_CTL, 0, 10, FALSE);

            SetScrollPos (GetDlgItem (hDlg, IDD_BLUELEVEL),
                          SB_CTL, wBNutrition, TRUE);


            if (sBugLimit > 100)
                i = ((sBugLimit - 100) / 10) + 100;
            else
                i = sBugLimit;

            SetScrollRange (GetDlgItem (hDlg, IDD_MAXBLEVEL),
                            SB_CTL, 0, (MAXBUGS-100)/10+100, FALSE);

            SetScrollPos (GetDlgItem (hDlg, IDD_MAXBLEVEL),
                          SB_CTL, i, TRUE);


            if (sBabyLevel > 100)
                i = ((sBabyLevel - 100) / 10) + 100;
            else
                i = sBabyLevel;

            SetScrollRange (GetDlgItem (hDlg, IDD_BIRTHLEVEL),
                            SB_CTL, 0, 500, FALSE);

            SetScrollPos (GetDlgItem (hDlg, IDD_BIRTHLEVEL),
                          SB_CTL, i, TRUE);


            if (sSustenance > 100)
                i = ((sSustenance - 100) / 10) + 100;
            else
                i = sSustenance;

            SetScrollRange (GetDlgItem (hDlg, IDD_SUSLEVEL),

                    SB_CTL, 0, 500, FALSE);

            SetScrollPos (GetDlgItem (hDlg, IDD_SUSLEVEL),
                          SB_CTL, i, TRUE);


            SendDlgItemMessage (hDlg, IDD_BIRTHCOLOR, BM_SETCHECK,
                                bBColorFlag, 0);

            SendDlgItemMessage (hDlg, IDD_DEATHCOLOR, BM_SETCHECK,
                                bDColorFlag, 0);

            SendDlgItemMessage (hDlg, IDD_PWENABLE, BM_SETCHECK,
                                bPWEnabled, 0);

            return TRUE;

        case WM_COMMAND:
            switch (wParam) {

                case IDD_BIRTHCOLOR:
                    if (HIWORD (lParam) == BN_CLICKED) {
                     if (SendDlgItemMessage (hDlg, IDD_BIRTHCOLOR,
                                             BM_GETCHECK, 0, 0) == 0)
                      SendDlgItemMessage (hDlg, IDD_BIRTHCOLOR, BM_SETCHECK,
                                          1, 0);
                     else
                      SendDlgItemMessage (hDlg, IDD_BIRTHCOLOR, BM_SETCHECK,
                                          0, 0);
                    }
                    break;

                case IDD_DEATHCOLOR:
                    if (HIWORD (lParam) == BN_CLICKED) {
                     if (SendDlgItemMessage (hDlg, IDD_DEATHCOLOR,
                                             BM_GETCHECK, 0, 0) == 0)
                      SendDlgItemMessage (hDlg, IDD_DEATHCOLOR, BM_SETCHECK,
                                          1, 0);
                     else
                      SendDlgItemMessage (hDlg, IDD_DEATHCOLOR, BM_SETCHECK,
                                          0, 0);
                    }
                    break;


                case IDD_PWENABLE:
                    if (HIWORD (lParam) == BN_CLICKED) {
                     if (SendDlgItemMessage (hDlg, IDD_PWENABLE,
                                             BM_GETCHECK, 0, 0) == 0)

                      SendDlgItemMessage (hDlg, IDD_PWENABLE, BM_SETCHECK,
                                          1, 0);
                     else
                      SendDlgItemMessage (hDlg, IDD_PWENABLE, BM_SETCHECK,
                                          0, 0);

                    }

                    break;

                case IDD_PWSET: {
                     FARPROC lpfnPWDlgProc;
                     lpfnPWDlgProc = MakeProcInstance (DlgChangePassword,
                                                       hMainInstance);
                     DialogBox (hMainInstance,
                                MAKEINTRESOURCE (DLG_CHANGEPASSWORD),
                                hDlg, lpfnPWDlgProc);
                     FreeProcInstance (lpfnPWDlgProc);
                    }
                    break;


                case IDD_HELP: {
                     FARPROC lpfnAboutDlgProc;
                     lpfnAboutDlgProc = MakeProcInstance (AboutDlgProc,
                                                          hMainInstance);
                     DialogBox (hMainInstance, "About", hDlg, lpfnAboutDlgProc);
                     FreeProcInstance (lpfnAboutDlgProc);
                    }
                    break;


                case IDOK:
                    i = GetScrollPos (GetDlgItem (hDlg, IDD_REDLEVEL), SB_CTL);
                    itoa (i, szTemp, 10);
                    WritePrivateProfileString (szAppName, "Red", szTemp,
                                               szIniName);
```

Figure 3: **ScreenSaverConfigureDialog provides the Dialog procedure for configuring the dialog box of BUGS.SCR.**

ScreenSaverConfigureDialog

2 of 2

```
i = GetScrollPos (GetDlgItem (hDlg, IDD_GREENLEVEL), SB_CTL);
itoa (i, szTemp, 10);
WritePrivateProfileString (szAppName, "Green", szTemp,
                           szIniName);

        i = GetScrollPos (GetDlgItem (hDlg, IDD_BLUELEVEL), SB_CTL);
        itoa (i, szTemp, 10);
        WritePrivateProfileString (szAppName, "Blue", szTemp,
                                   szIniName);


        i = GetScrollPos (GetDlgItem (hDlg, IDD_MAXBLEVEL), SB_CTL);
        if (i > 100) i = 100 + ((i - 100) * 10);
        itoa (i, szTemp, 10);
        WritePrivateProfileString (szAppName, "MaxBugs", szTemp,
                                   szIniName);


        i = GetScrollPos (GetDlgItem (hDlg, IDD_BIRTHLEVEL), SB_CTL);
        if (i > 100) i = 100 + ((i - 100) * 10);
        itoa (i, szTemp, 10);
        WritePrivateProfileString (szAppName, "BabyLevel", szTemp,
                                   szIniName);


        i = GetScrollPos (GetDlgItem (hDlg, IDD_SUSLEVEL), SB_CTL);
        if (i > 100) i = 100 + ((i - 100) * 10);
        itoa (i, szTemp, 10);
        WritePrivateProfileString (szAppName, "Sustenance", szTemp,
                                   szIniName);


        i = (int) SendDlgItemMessage (hDlg, IDD_BIRTHCOLOR,
                                      BM_GETCHECK, 0, 0);
        itoa (i, szTemp, 10);
        WritePrivateProfileString (szAppName, "BirthColor", szTemp,
                                   szIniName);
        i = (int) SendDlgItemMessage (hDlg, IDD_DEATHCOLOR,
                                      BM_GETCHECK, 0, 0);
        itoa (i, szTemp, 10);
        WritePrivateProfileString (szAppName, "DeathColor", szTemp,
                                   szIniName);
        i = (int) SendDlgItemMessage (hDlg, IDD_PWENABLE,
                                      BM_GETCHECK, 0, 0);
        itoa (i, szTemp, 10);
        WritePrivateProfileString (szAppName, szIsPassword, szTemp,
                                   szIniName);
        EndDialog (hDlg, TRUE);
        return TRUE;
    case IDCANCEL:
        EndDialog (hDlg, FALSE);
        return TRUE;

    }

    break;


case WM_HSCROLL:

    i = GetScrollPos (HIWORD (lParam), SB_CTL); // Get Scroll bar Pos
    j = GetDlgCtrlID (HIWORD (lParam));   // Get Scroll bar ID

    switch (wParam) {
        case SB_LINEUP:
            i--;
            break;


        case SB_LINEDOWN:
            i++;
            break;


        case SB_PAGEUP:
            if (j == IDD_REDLEVEL ||
                j == IDD_GREENLEVEL ||
                j == IDD_BLUELEVEL)
            i -=2;
            else
            i -= 10;
            break;


        case SB_PAGEDOWN:
            if (j == IDD_REDLEVEL ||
                j == IDD_GREENLEVEL ||
                j == IDD_BLUELEVEL)
            i += 2;
            else
            i += 10;
            break;

                case SB_THUMBTRACK:
                case SB_THUMBPOSITION:
                    i = LOWORD (lParam);
                    break;

            }

            SetScrollPos (HIWORD (lParam), SB_CTL, i, TRUE);


            switch (j) {
                case IDD_REDLEVEL:
                    SetText (hDlg, IDD_REDTEXT, i, "Red: ");
                    break;

                case IDD_GREENLEVEL:
                    SetText (hDlg, IDD_GREENTEXT, i, "Green: ");
                    break;

                case IDD_BLUELEVEL:
                    SetText (hDlg, IDD_BLUETEXT, i, "Blue: ");
                    break;

                case IDD_MAXBLEVEL:
                    if (i > 100) i = 100 + ((i - 100) * 10);
                    SetText (hDlg, IDD_MAXBTEXT, i, "Max Number of Bugs: ");
                    break;

                case IDD_SUSLEVEL:
                    if (i > 100) i = 100 + ((i - 100) * 10);
                    SetText (hDlg, IDD_SUSTEXT, i, "Sustenance Level: ");
                    break;

                case IDD_BIRTHLEVEL:
                    if (i > 100) i = 100 + ((i - 100) * 10);
                    SetText (hDlg, IDD_BIRTHTEXT, i, "Reproduction Level: ");
                    break;
            }
            break;
}
return FALSE;
```

In the version of BUGS that uses the Windows 3.1 SCRNSAVE routines, a 100-millisecond timer is used to trigger processing of the bug array. For the standalone version (BUGSBC.SCR), the bug array is processed continually whenever no messages are waiting in the window's message queue.

However the processing is triggered, the results are the same. The routine examines each bug structure. The next position of the bug is computed using a random number. For most bugs this means an equal chance of moving one pixel in any of eight possible directions (north, northeast, east, southeast, and so on). Once the bug is moved to the new location, the color value of the pixel is read using the Windows function GetPixel and the pixel is set to black using SetPixel. The color from the pixel, which is represented as a combination of red, green, and blue components, is multiplied by the color multiplier with this equation:

```
Pixel food value = (Red value * Red
Nutrition) + (Green value * Green
Nutrition) + (Blue value * Blue
Nutrition)
```

The food content is then added to the bug's current food value, kept in the wFood field of the bug structure.

Once the ingested calories have been added, the sustenance value is subtracted from the wFood field. If the bug's food value falls below zero, it is considered a dead bug and is consequently removed from the array. On the other hand, if the

RegisterDialogClasses

```
//=================================================================
//RegisterDialogClasses - Called by the screen saver applet during
//                        initialzation.
//=================================================================
BOOL    RegisterDialogClasses (HANDLE hInst) {
        //
        // Nothing to register !
        //
        return TRUE;
}
```

Figure 4: **The RegisterDialogClasses procedure is called before the dialog configuration box.**

PC Magazine Utilities Updates

Here's a partial list of the programs on PC MagNet that have been upgraded. To download these files from the Utilities/Tips Forum, type GO ZNT:TIPS, type LIB, or select Libraries from the menu, then select Library 2 PCMAG UTILS. Type DOW and the filename listed below (DOW ANSI.COM) or select Download a File from the menu.

ANSI.COM, Version 1.3
BAT2EXEC.COM, Version 1.5
BCOPY, Version 1.2
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CONFIG.CTL, Version 3.0
DIRMATCH.COM, Version 3.1
EMMA.COM, Version 2.2
EMS40.SYS, Version 1.1
PCACCESS.EXE, Version 1.1
RN.COM, Version 3.0
SLICE.COM, Version 1.3
SNIPPER.COM, Version 1.2
ZCOPY.COM, Version 1.4

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food value rises above the birth level, a new bug is added to the array. The baby bug's position is randomly placed within two pixels of its parent. The parent's food reserve value is then cut in half. The food value for the baby bug is set at twice the sustenance level, allowing the newborn to survive two turns before it must land on a lit pixel to get more food.

The bug array is sorted every 15 seconds so as to place the bugs with the largest caloric reserve at the start of the array. If the array is more than 80 percent full, the 20 percent of the bugs with the least food in their "stomachs" are removed from the array. Since the bugs are already sorted by efficiency, deleting the least productive 20 percent is simply a matter of reducing the count of bugs in the array. This ensures there will be room within the overall bug limit for any baby bugs that need to be born.

A second reason for sorting the bug array so frequently is that the top 10 percent of the bugs are to be designated as scout bugs. Scout bugs are enhanced by being provided with an additional vector component; as a result, their motion is not completely random.

This vector consists of a bias toward motion in one direction. Normally, the vector does not change between turns. If the food value of the last pixel the scout bug consumed was less than the current sustenance value, however, the vector is randomly recomputed. This gives the scout bugs an impetus to change direction when they find themselves in a dark area of the screen.

BUGS provides an instructional and entertaining example of how a Windows 3.1 screen saver works. The next step is for you to create your own! □

DOUGLAS BOLING IS A CONTRIBUTING EDITOR TO *PC MAGAZINE*.

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ENVIRONMENTS

Playing MIDI Files Using The Media Control Interface

BY CHARLES PETZOLD

I had originally intended to write a program that would demonstrate nearly all of the interesting things you can do with MIDI using the Media Control Interface (MCI) of the multimedia extensions to Windows. The program would then be something like the Media Player included in Windows 3.1, but a little more functional for MIDI. This job turned out to be easier than I expected in some ways, but more difficult in others.

MIDI support in MCI is very powerful—you can play an industry-standard MIDI file with just a few commands—but the support is not very broad. As I've noted before, MCI can't record MIDI messages originating from a keyboard (or other controller) and save them into a MIDI file.

At first I was very disappointed that I couldn't record from my MIDI keyboard into a MIDI file using MCI. (After all, MCI allows sound to be recorded in waveform files.) But after giving the matter some thought, I realized that adding MIDI recording facilities to MCI would have strained the capabilities of that high-level interface.

For example, you probably wouldn't want to create a MIDI file by playing on the keyboard just once. You'd like to go back and listen to what you recorded and add additional parts. If you made a mistake on a couple of notes, it would be convenient to change them through on-screen editing rather than re-recording. Some MIDI controllers only send MIDI messages over channels 1 or 2. You'd need some way to convert these messages to other channels. And some MIDI controllers have no way to send a MIDI Program Change message. You'd need a facility to define an instrument voice for a sequence that would be embedded in the MIDI file.

I eventually decided that creating MIDI files is best left to application software with a user interface that allows implementing these features. Meanwhile, let's explore what we can do with MCI to play MIDI files.

MIDI SEQUENCER COMMANDS As you may recall from previous columns, MCI exists in two forms: One is based on messages and data structures, and the other uses text strings. In practice, these are almost interchangeable. Internally, the MCI driver simply converts the text strings into the equivalent messages and data structures.

You can't use MCI to record MIDI messages and save them to MIDI files, but—as our sample program shows—you can use it to play and manipulate MIDI files.

It's easiest to get a feel for the MIDI support under MCI by examining the documentation for the text-string form of MCI, as shown in Chapter 7 of the *Multimedia Programmer's Reference* included in Microsoft's Windows 3.1 SDK (Software Development Kit). (The MIDI commands begin on page 7-52.) The Microsoft C/C++ 7.0 compiler and the Borland C++ 3.1 compiler also include an online MCI reference. Choose "MIDI Sequencer Commands" from the opening window.

Of particular interest are the *set* and *status* commands. These two commands allow you to set and query various aspects of the MIDI sequence:

- The set and status commands using the parameter *audio* involve turning the audio of the MIDI synthesizer on or off, either entirely, or independently for the left and right sound channels. These commands are not supported.
- The set and status commands using the *master* parameter involve using the MIDI timing information generated by MCI as a source of timing information for other hardware (for example, a standalone sequencer). These commands are not supported.
- The set and status commands using the *slave* parameter involve using an external time source for synchronizing MCI. This would be useful for synchronizing a MIDI music sequence for a soundtrack that accompanies video recorded on external VCRs. But these commands are not supported.
- The set and status commands using the *track* parameter *are* implemented but are not very useful. The MIDI file format can accommodate a file that contains more than one independent "track" of MIDI sequences. MCI only works with MIDI files that support one track, or multiple tracks that are played simultaneously.
- The set and status commands using the *offset* parameter involve setting and querying a SMPTE (Society of Motion Picture and Television Engineers) time code, normally stored in the MIDI file, that indicates when the sequence is supposed to begin. This is supported under MCI, but I decided not to implement it in my program because it only makes sense when using the MIDI file as a master or slave.

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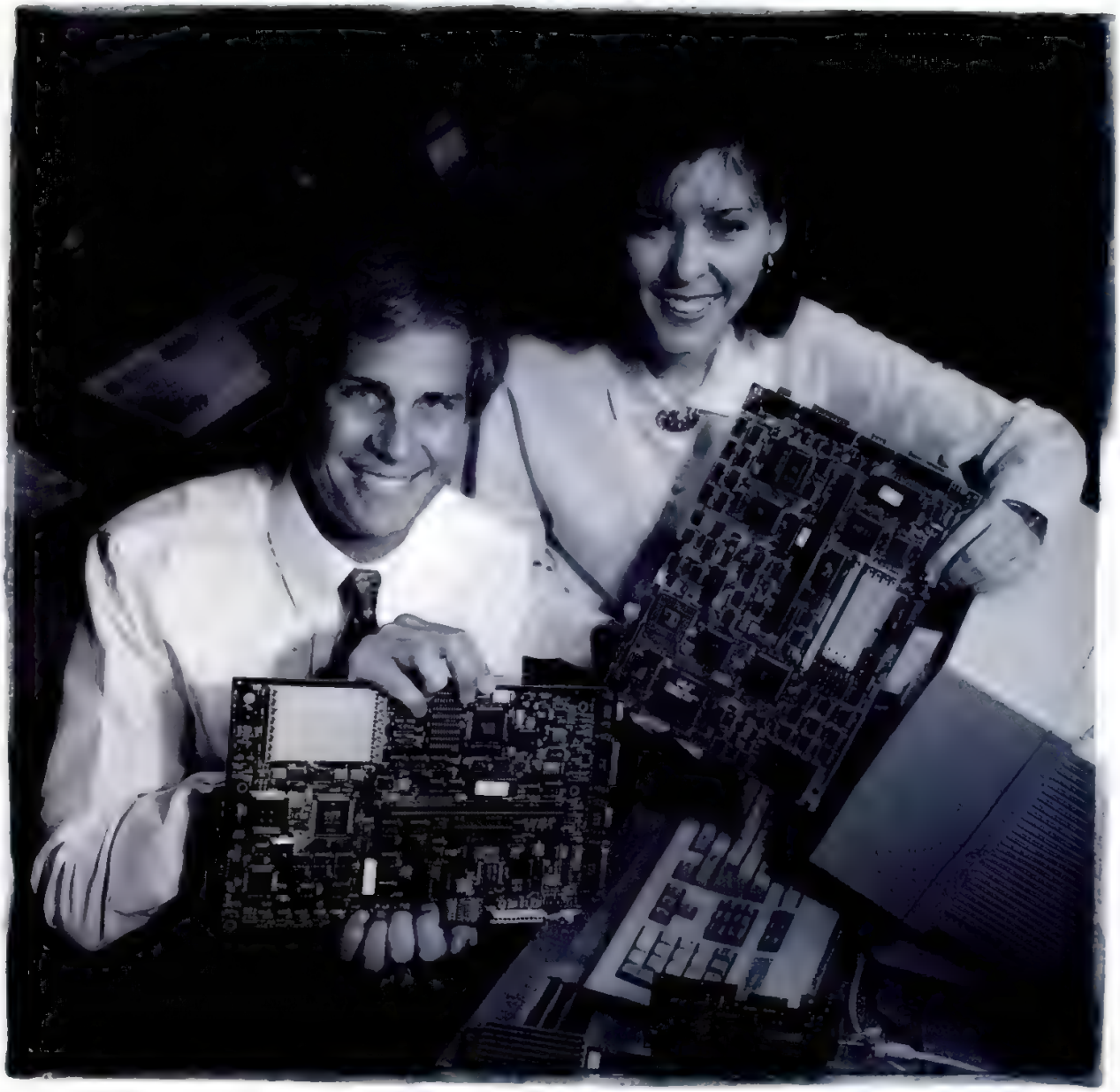

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• The set and status commands using the *port* parameter allow setting and querying the port used for playing the MIDI file. This port is equivalent to the device ID used in the midiOutOpen function, and indicates one of the MIDI devices installed on the PC or the MIDI Mapper device. I decided not to implement this in my program and instead used the default, which is the MIDI Mapper.

All the other set and status commands involve timing information; this turned out to be the hard part of writing my program because it required a good understanding of MIDI files.

A TERMINOLOGY REVIEW Music is a temporal art, and timing information is an important component of MIDI files. In the last issue, I discussed how this timing information is encoded in a MIDI file. Here's a brief terminology review:

The *division type* is encoded in the header section of the MIDI file and applies to the whole file. It indicates whether timing information is coded in parts per quarter note (PPQN) or parts of a frame in one of four SMPTE formats. The four SMPTE formats are 24 frames per second (movies), 25 frames per second (PAL and SECAM television standards used in Europe, Africa, and much of Asia), 30 frames per second (American television prior to 1953), and 29.92 frames per second (the NTSC television standard used in the Americas and Japan). The division type of a MIDI file can be obtained from MCI using the status command with the division type parameter. It cannot be changed using the set command.

The *division value* is also stored in the header section of the MIDI file. It indicates the number of parts into which a quarter note (for a PPQN file) or a frame (for a SMPTE file) is divided. All timing information in the file is based on this division value. You cannot obtain or change this value using MCI.

The *tempo* is encoded in the MIDI file as a meta-event, which is a small record that may be mixed in a MIDI message. Because the tempo of a musical composition can change for different sections, there can be more than one tempo meta-event in a file. For a PPQN file, the tempo is specified in the MIDI file as the number of microseconds per quarter note (by default, 500,000 microseconds, or 120 quarter notes per minute). For a SMPTE file, the tempo is implied by the frame rate. For example, for the SMPTE 25 format, each frame is 40,000 microseconds long. As nonsensical as it seems, however, tempo meta-events in a SMPTE file can alter that.

You can use the MCI status command with the tempo parameter to obtain the current tempo. For a PPQN file, MCI reports the tempo in quarter notes per minute. For a SMPTE file, the tempo is reported in frames per second. You can also use the MCI set command with the tempo parameter to set a different tempo as the MIDI file is being played.

Each MIDI message in the file is preceded by a *delta time.* After sending a MIDI message to a synthesizer, the software playing the file waits this period of time before sending the next message. For either PPQN or SMPTE files, a delta time can be converted to a millisecond duration with the following formula:

$$\text{Duration/ms.} = \frac{\text{Tempo}}{1000} * \frac{\text{Delta time}}{\text{Division}}$$

The total time required to play a MIDI file can be calculated by totaling all the delta times within the file, and then performing this calculation. However, it may be more complex than that if there are multiple tempo meta-events in the file.

You can use the MCI status command with the *length* parameter to obtain the total length of a MIDI file or—as it's being played—the current position using the *position* parameter. You can also change the position using the set command with the *position* parameter to skip ahead or back within the file. The file length and current position are specified in one of six time formats: milliseconds, the four SMPTE formats (in which the time is in units of hours, minutes, seconds,

MIDPLA.C

1 of 4

```
/*----------------------------------------
   MIDPLA.C -- MIDI File Player
               (c) Charles Petzold, 1992
  ----------------------------------------*/

#include <windows.h>
#include <mmsystem.h>
#include <commdlg.h>
#include <stdlib.h>
#include <string.h>
#include "midpla.h"

#define ID_TIMER            1
#define MIN_TEMPO_BPS      20
#define MAX_TEMPO_BPS     480
#define MIN_TEMPO_SMPTE     5
#define MAX_TEMPO_SMPTE   120

#define min(a,b) (((a) < (b)) ? (a) : (b))
#define max(a,b) (((a) > (b)) ? (a) : (b))

#define EnableDlgWindow(hwnd, wID, bEnable) \
               (EnableWindow (GetDlgItem ((hwnd), (wID)), (bEnable)))

BOOL FAR PASCAL _export DlgProc (HWND, UINT, UINT, LONG) ;

static char szAppName [] = "MidPla" ;

int PASCAL WinMain (HANDLE hInstance, HANDLE hPrevInstance,
                    LPSTR lpszCmdLine, int nCmdShow)
     {
     FARPROC lpDlgProc ;

     lpDlgProc = MakeProcInstance ((FARPROC) DlgProc, hInstance) ;

     DialogBox (hInstance, szAppName, NULL, lpDlgProc) ;
     FreeProcInstance (lpDlgProc) ;

     return 0 ;
     }

     /*-------------------------------------------
        mciSendCommand with an error message display
       -------------------------------------------*/

BOOL MciSend (UINT wDeviceID, UINT wMessage, DWORD dwParam1, DWORD dwParam2)
     {
     static char szBuffer [256] ;
     DWORD       dwError ;
     HWND        hwnd ;

     dwError = mciSendCommand (wDeviceID, wMessage, dwParam1, dwParam2) ;

     if (dwError)
          {
          hwnd = (HWND) ((LPMCI_GENERIC_PARMS) dwParam2)->dwCallback ;

          if (!mciGetErrorString (dwError, szBuffer, sizeof (szBuffer)))
               strcpy (szBuffer, "Error not known") ;

          MessageBox (hwnd, szBuffer, szAppName, MB_OK | MB_ICONEXCLAMATION) ;
          }

     return dwError == 0 ;
     }

     /*---------------
        Open function
       ---------------*/
```

Figure 1: **MIDPLA.C has all the source code for the MIDI player program.**

MIDPLA.C

2 of 4

```
UINT MciMidiOpen (HWND hwnd, char * szFileName, DWORD dwFlags)
     {
     BOOL           bSuccess ;
     MCI_OPEN_PARMS open ;

     open.dwCallback       = (DWORD) hwnd ;
     open.lpstrDeviceType  = "sequencer" ;
     open.lpstrElementName = szFileName ;
     open.lpstrAlias       = NULL ;

     bSuccess = MciSend (0, MCI_OPEN,
                         MCI_OPEN_ELEMENT | MCI_OPEN_TYPE | dwFlags,
                         (DWORD) (LPMCI_OPEN_PARMS) &open) ;

     return bSuccess ? open.wDeviceID : 0 ;
     }

     /*-----------------------------------------------------------------
        Functions and macros for operations using the generic structure
       -----------------------------------------------------------------*/

BOOL MciMidiGeneric (UINT wDeviceID, HWND hwnd, UINT wMessage, DWORD dwFlags)
     {
     MCI_GENERIC_PARMS generic ;

     generic.dwCallback = (DWORD) hwnd ;

     return MciSend (wDeviceID, wMessage, dwFlags,
                     (DWORD) (LPMCI_GENERIC_PARMS) &generic) ;
     }

#define MciMidiClose(wDeviceID, hwnd, dwFlags) \
                (MciMidiGeneric ((wDeviceID), (hwnd), MCI_CLOSE,  (dwFlags)))

#define MciMidiPause(wDeviceID, hwnd, dwFlags) \
                (MciMidiGeneric ((wDeviceID), (hwnd), MCI_PAUSE,  (dwFlags)))

#define MciMidiStop(wDeviceID, hwnd, dwFlags) \
                (MciMidiGeneric ((wDeviceID), (hwnd), MCI_STOP,   (dwFlags)))

     /*-----------------------------
        MIDI Play and Seek functions
       -----------------------------*/

BOOL MciMidiPlay (UINT wDeviceID, HWND hwnd, DWORD dwFlags, DWORD dwFrom,
                                                            DWORD dwTo)
     {
     MCI_PLAY_PARMS play ;

     play.dwCallback = (DWORD) hwnd ;
     play.dwFrom     = dwFrom ;
     play.dwTo       = dwTo ;

     return MciSend (wDeviceID, MCI_PLAY, dwFlags,
                     (DWORD) (LPMCI_PLAY_PARMS) &play) ;
     }

BOOL MciMidiSeek (UINT wDeviceID, HWND hwnd, DWORD dwFlags, DWORD dwTo)
     {
     MCI_SEEK_PARMS seek ;

     seek.dwCallback = (DWORD) hwnd ;
     seek.dwTo       = dwTo ;

     return MciSend (wDeviceID, MCI_SEEK, dwFlags,
                     (DWORD) (LPMCI_SEEK_PARMS) &seek) ;
     }

     /*-----------------------------------------------------
        Functions and macros to obtain status information
       -----------------------------------------------------*/

DWORD MciMidiGet (UINT wDeviceID, HWND hwnd, DWORD dwFlags, DWORD dwItem)
     {
     BOOL             bSuccess ;
     MCI_STATUS_PARMS status ;

     status.dwCallback = (HWND) hwnd ;
     status.dwItem     = dwItem ;

     bSuccess = MciSend (wDeviceID, MCI_STATUS, dwFlags | MCI_STATUS_ITEM,
                         (DWORD) (LPMCI_STATUS_PARMS) & status) ;

     return bSuccess ? status.dwReturn : 0 ;
     }

#define MciMidiGetMode(wDeviceID, hwnd, dwFlags) \
          MciMidiGet ((wDeviceID), (hwnd), (dwFlags), MCI_STATUS_MODE)

#define MciMidiGetDivType(wDeviceID, hwnd, dwFlags) \
          MciMidiGet ((wDeviceID), (hwnd), (dwFlags), MCI_SEQ_STATUS_DIVTYPE)

#define MciMidiGetFormat(wDeviceID, hwnd, dwFlags) \
          MciMidiGet ((wDeviceID), (hwnd), (dwFlags), MCI_STATUS_TIME_FORMAT)

#define MciMidiGetLength(wDeviceID, hwnd, dwFlags) \
          MciMidiGet ((wDeviceID), (hwnd), (dwFlags), MCI_STATUS_LENGTH)

#define MciMidiGetPosition(wDeviceID, hwnd, dwFlags) \
          MciMidiGet ((wDeviceID), (hwnd), (dwFlags), MCI_STATUS_POSITION)

#define MciMidiGetTempo(wDeviceID, hwnd, dwFlags) \
          MciMidiGet ((wDeviceID), (hwnd), (dwFlags), MCI_SEQ_STATUS_TEMPO)

     /*---------------------------------------
        Functions to set time format and tempo
       ---------------------------------------*/

BOOL MciMidiSetFormat (UINT wDeviceID, HWND hwnd, DWORD dwFlags, DWORD dwFormat)
     {
     MCI_SEQ_SET_PARMS set ;

     set.dwCallback   = (HWND) hwnd ;
     set.dwTimeFormat = dwFormat ;

     return MciSend (wDeviceID, MCI_SET, dwFlags | MCI_SET_TIME_FORMAT,
                     (DWORD) (LPMCI_SEQ_SET_PARMS) & set) ;
     }

BOOL MciMidiSetTempo (UINT wDeviceID, HWND hwnd, DWORD dwFlags, DWORD dwTempo)
     {
     MCI_SEQ_SET_PARMS set ;

     set.dwCallback = (HWND) hwnd ;
     set.dwTempo    = dwTempo ;

     return MciSend (wDeviceID, MCI_SET, dwFlags | MCI_SEQ_SET_TEMPO,
                     (DWORD) (LPMCI_SEQ_SET_PARMS) & set) ;
     }

     /*--------------------------------
        Update the labels on the window
       --------------------------------*/

void UpdateLabels (UINT wDeviceID, HWND hwnd)
     {
     char  szPosBeg [16], szPosEnd [16], szPosition [40], szTempo [40] ;
     DWORD dwDivType, dwFormat, dwLength, dwPosition, dwTempo ;
     UINT  iPosition, iTempo ;

          // Get information

     dwDivType  = MciMidiGetDivType  (wDeviceID, hwnd, MCI_WAIT) ;
     dwFormat   = MciMidiGetFormat   (wDeviceID, hwnd, MCI_WAIT) ;
     dwLength   = MciMidiGetLength   (wDeviceID, hwnd, MCI_WAIT) ;
     dwPosition = MciMidiGetPosition (wDeviceID, hwnd, MCI_WAIT) ;
     dwTempo    = MciMidiGetTempo    (wDeviceID, hwnd, MCI_WAIT) ;

          // Format the length and position values, calculate position scroll

     if (dwFormat == MCI_FORMAT_MILLISECONDS ||
         dwFormat == MCI_SEQ_FORMAT_SONGPTR)
          {
          wsprintf (szPosBeg,   "0") ;
          wsprintf (szPosEnd,   "%ld", dwLength) ;
          wsprintf (szPosition, "Position: %ld %s", dwPosition,
                    (LPSTR) (dwFormat == MCI_FORMAT_MILLISECONDS ?
                                 "milliseconds" : "sixteenth notes")) ;

          iPosition = (UINT) (1000 * dwPosition / dwLength) ;
          }
     else
          {
          wsprintf (szPosBeg, "00:00:00:00") ;

          wsprintf (szPosEnd, "%02d:%02d:%02d:%02d",
                    LOBYTE (LOWORD (dwLength)), HIBYTE (LOWORD (dwLength)),
                    LOBYTE (HIWORD (dwLength)), HIBYTE (HIWORD (dwLength))) ;

          wsprintf (szPosition, "Position: %02d:%02d:%02d:%02d",
                   LOBYTE (LOWORD (dwPosition)), HIBYTE (LOWORD (dwPosition)),
                   LOBYTE (HIWORD (dwPosition)), HIBYTE (HIWORD (dwPosition))) ;

                    // (switch to millisecond format for scroll bar calc)

          MciMidiSetFormat (wDeviceID, hwnd,
                            MCI_WAIT, MCI_FORMAT_MILLISECONDS) ;

          iPosition = (UINT) (1000 *
                              MciMidiGetPosition (wDeviceID, hwnd, MCI_WAIT) /
                              MciMidiGetLength   (wDeviceID, hwnd, MCI_WAIT))
;

          MciMidiSetFormat (wDeviceID, hwnd, MCI_WAIT, dwFormat) ;
          }

          // Format the tempo, calculate tempo scroll

     if (dwDivType == MCI_SEQ_DIV_PPQN)
          {
          wsprintf (szTempo,  "Tempo: %ld quarter notes per minute", dwTempo) ;

          iTempo = (UINT) (max (MIN_TEMPO_BPS, min (dwTempo, MAX_TEMPO_BPS))) ;
          }
     else
          {
          wsprintf (szTempo, "Tempo: %ld frames per second", dwTempo) ;

          iTempo = (UINT) (max (MIN_TEMPO_SMPTE,
                                min (dwTempo, MAX_TEMPO_SMPTE))) ;
          }
```

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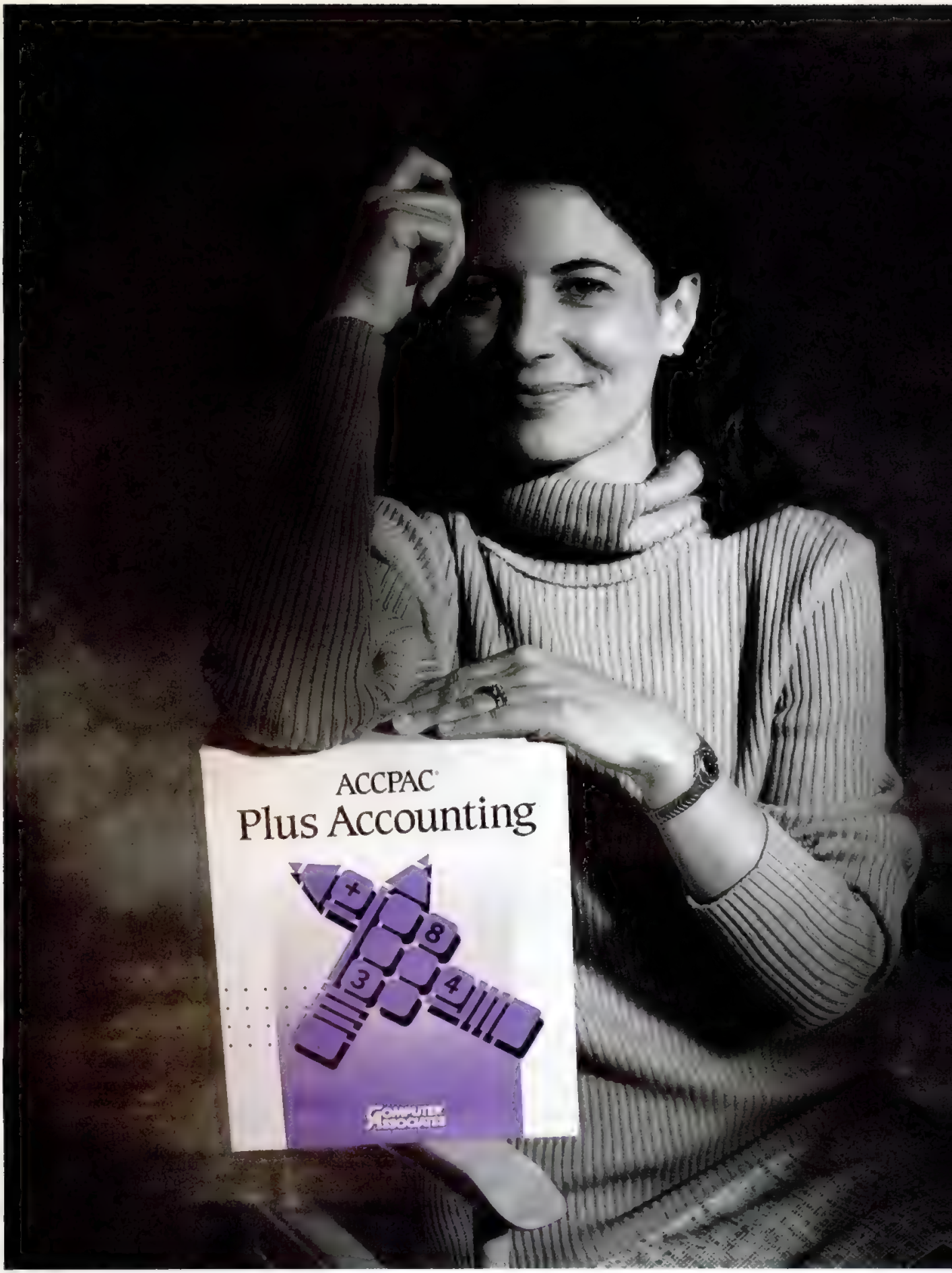

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MIDPLA.C


```
        // Set text and scroll bar positions

    SetDlgItemText (hwnd, ID_POSBEG,  szPosBeg) ;
    SetDlgItemText (hwnd, ID_POSEND,  szPosEnd) ;
    SetDlgItemText (hwnd, ID_POSTEXT, szPosition) ;
    SetDlgItemText (hwnd, ID_TMPTEXT, szTempo) ;

    SetScrollPos (GetDlgItem (hwnd, ID_POSITION), SB_CTL, iPosition, TRUE) ;
    SetScrollPos (GetDlgItem (hwnd, ID_TEMPO),    SB_CTL, iTempo,    TRUE) ;
    }

    /*---------------------------
       Main dialog box procedure
      ---------------------------*/

BOOL FAR PASCAL _export DlgProc (HWND hwnd, UINT message, UINT wParam,
                                                          LONG lParam)
    {
    static char         szFileName  [_MAX_PATH],
                        szTitleName [_MAX_FNAME + _MAX_EXT] ;
    static char *       szFilter[] = { "MIDI Sequencer (*.mid;*.rmi)",
                                       "*.mid;*.rmi", "" } ;
    static DWORD        dwFormats [] = { MCI_FORMAT_MILLISECONDS,
                                         MCI_SEQ_FORMAT_SONGPTR,
                                         MCI_FORMAT_SMPTE_24,
                                         MCI_FORMAT_SMPTE_25,
                                         MCI_FORMAT_SMPTE_30,
                                         MCI_FORMAT_SMPTE_30DROP } ;
    static OPENFILENAME ofn = { sizeof (OPENFILENAME) } ;
    static UINT         wDeviceID ;
    int                 i, iPosition, iTempo, iMin, iMax ;
    DWORD               dwDivType, dwFormat, dwMode ;

    switch (message)
        {
        case WM_INITDIALOG:

                        // Initialize OPENFILENAME structure

            ofn.hwndOwner      = hwnd ;
            ofn.lpstrFilter    = szFilter [0] ;
            ofn.lpstrFile      = szFileName ;
            ofn.nMaxFile       = sizeof (szFileName) ;
            ofn.lpstrFileTitle = szTitleName ;
            ofn.nMaxFileTitle  = sizeof (szTitleName) ;
            ofn.Flags          = OFN_FILEMUSTEXIST |
                                 OFN_PATHMUSTEXIST ;
            ofn.lpstrDefExt    = "mid" ;

                        // Initialize position scroll bar

            SetScrollRange (GetDlgItem (hwnd, ID_POSITION),
                            SB_CTL, 0, 1000, FALSE) ;

            SetScrollPos   (GetDlgItem (hwnd, ID_POSITION),
                            SB_CTL, 0, FALSE) ;
            return TRUE ;

        case WM_COMMAND:
            switch (wParam)
                {
                case ID_OPEN:
                                // Display open-file dialog box

                        if (!GetOpenFileName (&ofn))
                            return TRUE ;

                                // Open the file

                        wDeviceID = MciMidiOpen (hwnd, szFileName, MCI_WAIT) ;

                        if (0 == wDeviceID)
                            return TRUE ;

                                // Possibly disable song pointer button

                        dwDivType = MciMidiGetDivType (wDeviceID, hwnd,
                                                       MCI_WAIT) ;

                        EnableDlgWindow (hwnd, ID_SONGPTR,
                                         dwDivType == MCI_SEQ_DIV_PPQN) ;

                                // Set the tempo scroll bar range

                        if (dwDivType == MCI_SEQ_DIV_PPQN)
                            {
                            SetScrollRange (GetDlgItem (hwnd, ID_TEMPO),
                                SB_CTL, MIN_TEMPO_BPS, MAX_TEMPO_BPS, TRUE) ;

                            SetDlgItemInt (hwnd, ID_TMPMIN, MIN_TEMPO_BPS,
                                           FALSE) ;

                            SetDlgItemInt (hwnd, ID_TMPMAX, MAX_TEMPO_BPS,
                                           FALSE) ;
                            }
                        else
                            {
                            SetScrollRange (GetDlgItem (hwnd, ID_TEMPO),
                                SB_CTL, MIN_TEMPO_SMPTE, MAX_TEMPO_SMPTE,
                                TRUE) ;

                            SetDlgItemInt (hwnd, ID_TMPMIN, MIN_TEMPO_SMPTE,
                                           FALSE) ;

                            SetDlgItemInt (hwnd, ID_TMPMAX, MAX_TEMPO_SMPTE,
                                           FALSE) ;
                            }

                                // Find the default time format

                        dwFormat = MciMidiGetFormat (wDeviceID, hwnd,
                                                     MCI_WAIT) ;

                        for (i = 0 ; i < 6 ; i++)
                            if (dwFormat == dwFormats [i])
                                break ;

                        CheckRadioButton (hwnd, ID_MILLISECS,
                                ID_SMPTE30DF, ID_MILLISECS + i) ;

                                // Display labels

                        iPosition = 0 ;
                        UpdateLabels (wDeviceID, hwnd) ;

                                // Ready to play

                        EnableDlgWindow (hwnd, ID_OPEN,  FALSE) ;
                        EnableDlgWindow (hwnd, ID_PLAY,  TRUE)  ;
                        EnableDlgWindow (hwnd, ID_CLOSE, TRUE)  ;
                        SetFocus (GetDlgItem (hwnd, ID_PLAY)) ;

                        return TRUE ;

                case ID_PLAY:
                        if (MciMidiPlay (wDeviceID, hwnd, MCI_NOTIFY, 0, 0))
                            {
                            EnableDlgWindow (hwnd, ID_PLAY,  FALSE) ;
                            EnableDlgWindow (hwnd, ID_PAUSE, TRUE)  ;
                            EnableDlgWindow (hwnd, ID_STOP,  TRUE)  ;
                            EnableDlgWindow (hwnd, ID_CLOSE, FALSE) ;

                            SetFocus (GetDlgItem (hwnd, ID_STOP)) ;

                            SetTimer (hwnd, 1, 250, NULL) ;
                            }

                        return TRUE ;

                case ID_PAUSE:
                        if (MciMidiPause (wDeviceID, hwnd, MCI_WAIT))
                            {
                            EnableDlgWindow (hwnd, ID_PLAY,  TRUE)  ;
                            EnableDlgWindow (hwnd, ID_PAUSE, FALSE) ;

                            SetFocus (GetDlgItem (hwnd, ID_PLAY)) ;

                            KillTimer (hwnd, 1) ;
                            UpdateLabels (wDeviceID, hwnd) ;
                            }

                        return TRUE ;

                case ID_STOP:
                        if (MciMidiStop (wDeviceID, hwnd, MCI_WAIT))
                            {
                            EnableDlgWindow (hwnd, ID_PLAY,  TRUE)  ;
                            EnableDlgWindow (hwnd, ID_PAUSE, FALSE) ;
                            EnableDlgWindow (hwnd, ID_STOP,  FALSE) ;
                            EnableDlgWindow (hwnd, ID_CLOSE, TRUE)  ;

                            SetFocus (GetDlgItem (hwnd, ID_PLAY)) ;

                            KillTimer (hwnd, 1) ;
                            UpdateLabels (wDeviceID, hwnd) ;
                            }

                        return 0 ;

                case ID_CLOSE:
                        if (MciMidiClose (wDeviceID, hwnd, MCI_WAIT))
                            {
                            EnableDlgWindow (hwnd, ID_OPEN,  TRUE)  ;
                            EnableDlgWindow (hwnd, ID_PLAY,  FALSE) ;
                            EnableDlgWindow (hwnd, ID_CLOSE, FALSE) ;

                            SetFocus (GetDlgItem (hwnd, ID_OPEN)) ;

                            wDeviceID = 0 ;
                            }

                        return TRUE ;

                case ID_MILLISECS:
                case ID_SONGPTR:
                case ID_SMPTE24:
                case ID_SMPTE25:
                case ID_SMPTE30:
                case ID_SMPTE30DF:
                        dwFormat = wParam - ID_MILLISECS ;
```

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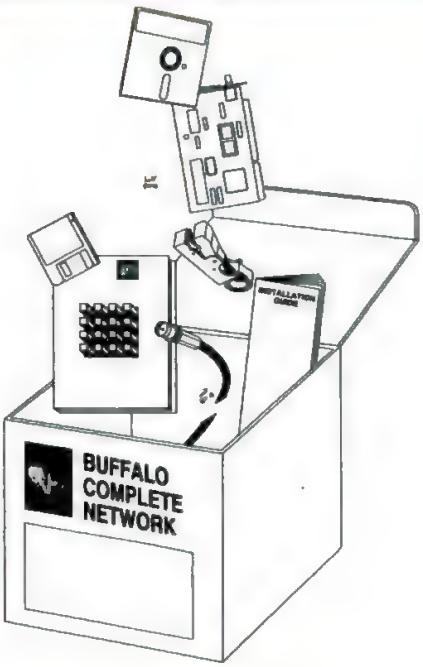

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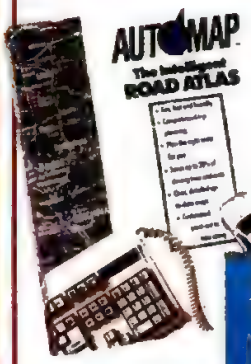

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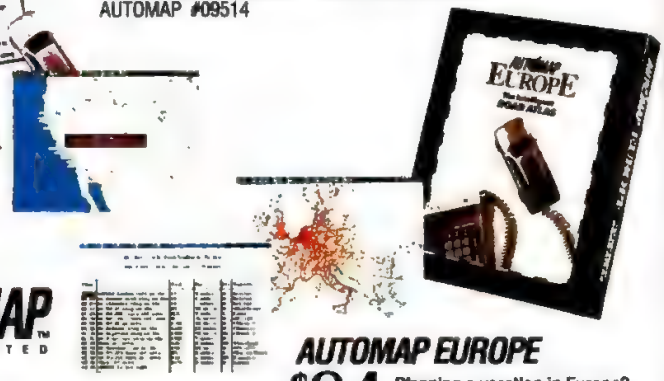

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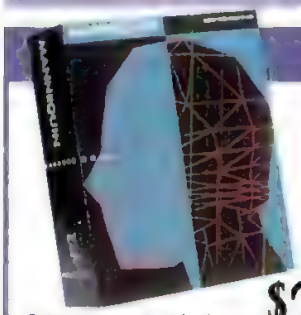

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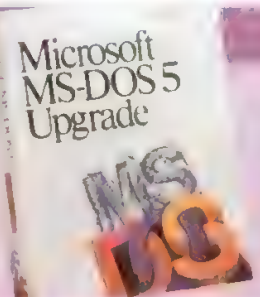

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Alpha Four 2.0 #07474 $348

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Microsoft Windows

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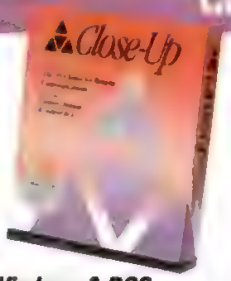

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Close-Up
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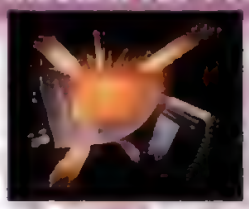
This powerful package won both PC Magazine's "Editor's Choice" award and PC World's "Best Buy" award in 1992. Close-Up 4.0 is a new remote communications software solution that lets you view and operate PCs miles away by modem. Run Windows or DOS applications with remote mouse control. For the fastest remote screens and file transfers, get Close-Up.
Norton Lambert #09917 • 5.25" #09918 • 3.5"



OverDrive Processor 20 Mhz $478

The Intel OverDrive Processor is a powerful single-chip performance booster that allows a simple yet dramatic upgrade for virtually any Intel 486 SX CPU-based system. The OverDrive Processor accelerates integer and math performance, delivering an overall performance boost of up to 70%. You'll see a performance boost for all DOS, Windows, OS/2 and UNIX applications from AutoCAD to WordPerfect. Intel #11424

OverDrive Processor 25 Mhz #11425 ..... $598

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Carbon Copy $118

Winner of the 1992 WIN Award presented by Windows Magazine, Carbon Copy for Windows is the "closest thing to having a remote control built into Windows itself." From your PC, access your office PC from home, check e-mail messages while traveling or collaborate on a document with a co-worker in another building. An easy-to-use file transfer utility, complete with data compression and error correction, enables you to transfer files fast and error-free. Microcom #07731

Carbon Copy DOS #09466 ..... $132
Micro Courier for Windows #07732 ..... $62

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BitFax is everything a fax program should be. With WYSIWYG faxing, your screen view is just what you will fax. Other features let you import an existing phone list for use with BitFax, fax pages from several Windows applications in the same fax, and receive faxes in the background while you work. In addition, BitCom offers a powerful script language, popular file transfer protocols and extensive terminal emulation. Bit Software #10827

BitCom #11070 ..... $48
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Felix is a stationary finger actuated mouse with precision fluid movement and feather weight control. It uses the same motion as writing, so with a flick of your finger it can dart to a pinpoint pixel. Leaping ahead of traditional mouse technology, the Felix mouse uses advanced optics and an on-board microprocessor for precise cursor movement
Altra #09520

PenMate $208

PenMate does for Pen-Windows what the mouse did for Windows. Exclusive PenMate utility software makes access to frequently used Windows commands simple. The PenMate (featuring two-buttons) can also be used as a standard Microsoft Mouse. This means that you can just plug in the PenMate and you're ready to go.
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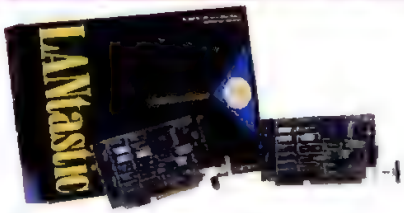

One of the newest developments in information systems for power-using businesses is the installation of a Local Area Network, or LAN. Functioning much like a server, a LAN lets connected PCs access shared information. But a LAN has many advantages. It allows PCs to function as peers, able to use each others full functions from any unit on the connected system. Any PC accessing the LAN also has full use of all connected peripherals, as if it were connected to them directly. A Local Area Network can also be accessed from a remote PC not on the network; even one connected to another LAN in another city (via modem). The configurations of a LAN are almost limitless. And the benefits of sharing information in a peer-to-peer fashion will have you wondering how you ever did business without one.

LANtastic AE-2 Starter Kit for Windows $544

With the LANtastic for Windows Starter Kit, you get an intuitive Windows interface plus everything you need to network your first two PCs. This pack includes software, hardware, cabling and clear, useful documentation. It features the newest version of the full-featured, easy-to-use LANtastic networking system, 4.1. And by buying the kit instead of each piece separately, you save a lot of money.
Artisoft #11222

LANtastic AE-3 Starter Kit for Windows #11223 ..... $624

Netware 3.11

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Creative Labs #10728

Sound Blaster Pro #09919 ..... $188

ATI Graphics Ultra 1MB

$478 The Graphics Ultra offers high-performance and speed for video graphics, plus a co-processor, all in one card. Its advanced VRAM makes it ATI's fastest new video card. It runs Windows 24x faster than Super VGA cards and 2x faster than TI cards. Demanding applications like CAD, DTP and even Windows will run faster than ever. Plus, you get a built-in mouse port and a Microsoft-compatible mouse. ATI #07739

Vantage 1MB #07187 ..... $228
Wonder XL 1MB #10683 ..... $204

NEW

Trak101 Trackball Keyboard $168

With all of the software advancements being made, your hardware may be falling behind. The new Trak101 from Key Tronic is THE keyboard for Windows. It not only works perfectly with your latest software, it lets you customize trackball operations in a variety of configurations. So now you can maximize your comfort and increase productivity, with the Trak101. Key Tronic #11324

NEC

NEC 4FG Monitor $778

This 15" perfectly flat screen is packed with state-of-the-art extras. For example, the new NEC FullScan capabilities which allow you to see up to 36% more active screen display. The AccuColor control system with digital controls give you crisper, deeper, truer colors than you've ever seen before. NEC #07143

NEC 3FGx Monitor #07144 ..... $658
NEC 5FG Monitor #07399 ..... $1398
NEC 6FG Monitor #07182 ..... $2464

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NEW

Thunder & Lightning $218

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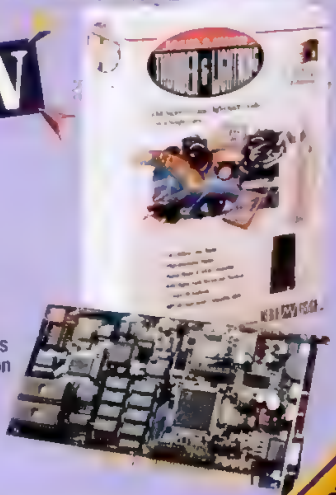
Media Vision #11301



ThunderBoard for Windows #10572 ..... $98
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MIDPLA.C

4 of 4

```
            if (MciMidiSetFormat (wDeviceID, hwnd, MCI_WAIT,
                                  dwFormats [dwFormat]))
                {
                CheckRadioButton (hwnd, ID_MILLISECS,
                          ID_SMPTE30DF, wParam) ;

                UpdateLabels (wDeviceID, hwnd) ;
                }

            return TRUE ;

        default:
            break ;
        }

    return TRUE ;

case WM_HSCROLL:
    switch (GetDlgCtrlID (HIWORD (lParam)))
        {
        case ID_POSITION:
            iPosition = GetScrollPos (
                        GetDlgItem (hwnd, ID_POSITION), SB_CTL) ;

            switch (wParam)
                {
                case SB_LEFT:       iPosition  =    0 ;  break ;
                case SB_LINELEFT:   iPosition -=   10 ;  break ;
                case SB_PAGELEFT:   iPosition -=  100 ;  break ;
                case SB_PAGERIGHT:  iPosition +=  100 ;  break ;
                case SB_LINERIGHT:  iPosition +=   10 ;  break ;
                case SB_RIGHT:      iPosition  = 1000 ;  break ;

                case SB_THUMBPOSITION:
                    iPosition = LOWORD (lParam) ;
                    break ;

                default:
                    return TRUE ;
                }

            iPosition = max (0, min (iPosition, 1000)) ;

            SetScrollPos (GetDlgItem (hwnd, ID_POSITION),
                      SB_CTL, iPosition, FALSE) ;

            if (wDeviceID)
                {
                    // Save existing time format

                dwFormat = MciMidiGetFormat (wDeviceID, hwnd,
                                             MCI_WAIT) ;

                    // Set time format to milliseconds

                MciMidiSetFormat (wDeviceID, hwnd, MCI_WAIT,
                                  MCI_FORMAT_MILLISECONDS) ;

                    // Find out if we're currently playing

                dwMode = MciMidiGetMode (wDeviceID, hwnd,
                                         MCI_WAIT) ;

                    // Perform a seek

                MciMidiSeek (wDeviceID, hwnd, MCI_WAIT | MCI_TO,
                    iPosition * MciMidiGetLength (wDeviceID,
                                hwnd, MCI_WAIT) / 1000) ;

                    // Reset the time format

                MciMidiSetFormat (wDeviceID, hwnd,
                                  MCI_WAIT, dwFormat) ;

                    // Update the scroll bar labels

                UpdateLabels (wDeviceID, hwnd) ;

                    // Continue playing

                if (dwMode == MCI_MODE_PLAY)
                    SendMessage (hwnd, WM_COMMAND, ID_PLAY, 0L) ;
                }

            return TRUE ;

        case ID_TEMPO:
            iTempo = GetScrollPos (
                    GetDlgItem (hwnd, ID_TEMPO), SB_CTL) ;

            GetScrollRange (GetDlgItem (hwnd, ID_TEMPO), SB_CTL,
                            &iMin, &iMax) ;

            switch (wParam)
                {
                case SB_LEFT:       iTempo  = iMin ;  break ;
                case SB_LINELEFT:   iTempo -=    1 ;  break ;
                case SB_PAGELEFT:   iTempo -=   10 ;  break ;
                case SB_PAGERIGHT:  iTempo +=   10 ;  break ;
                case SB_LINERIGHT:  iTempo +=    1 ;  break ;
                case SB_RIGHT:      iTempo  = iMax ;  break ;

                case SB_THUMBPOSITION:
                    iTempo = LOWORD (lParam) ;
                    break ;

                default:
                    return TRUE ;
                }

            iTempo = max (iMin, min (iTempo, iMax)) ;

            SetScrollPos (GetDlgItem (hwnd, ID_TEMPO),
                          SB_CTL, iTempo, FALSE) ;

            if (wDeviceID)
                {
                    // Set the new tempo

                MciMidiSetTempo (wDeviceID, hwnd,
                                 MCI_WAIT, iTempo) ;

                    // Update the scroll bar labels

                UpdateLabels (wDeviceID, hwnd) ;
                }

            return TRUE ;
        }

    return TRUE ;

case WM_TIMER:
    UpdateLabels (wDeviceID, hwnd) ;
    return TRUE ;

case MM_MCINOTIFY:
    if (wParam == MCI_NOTIFY_SUCCESSFUL)
        SendMessage (hwnd, WM_COMMAND, ID_STOP, 0L) ;

    return TRUE ;

case WM_SYSCOMMAND:
    switch (wParam)
        {
        case SC_CLOSE:
            if (wDeviceID)
                SendMessage (hwnd, WM_COMMAND, ID_CLOSE, 0L) ;

            EndDialog (hwnd, 0) ;
            return TRUE ;
        }
    break ;
    }
return FALSE ;
}
```

and frames), or song pointers, which give a duration in number of sixteenth notes. The default time format is implied by the file. MCI will use the song pointer for PPQN files and one of the SMPTE formats for SMPTE files.

You can use the MCI set command with a *time format* parameter to change the time format; the only exception is that you can't use the song pointer time format with a SMPTE file. All of the subsequent length and position information will be in that time format.

THE MIDI PLAY PROGRAM With that background, we are ready to look at the MIDPLA ("MIDI Player") program. Figure 1 shows the C listing for MIDPLA. The resource script is shown in Figure 2. Both of these files, as well as the rest of the source files and the executable, can be downloaded from PC MagNet archived as MIDPLA.ZIP.

MIDPLA uses a dialog box as its main window, with five push buttons for the basic operations of opening, playing, pausing, stopping, and closing a MIDI file; two scroll bars for changing the current position and tempo; and five radio-buttons for selecting the time format. The window is shown in Figure 3.

I used the message and structure form of MCI rather than the text-string form in MIDPLA because I knew that MIDPLA would be performing calculations based on the length of the sequence and the current position, and it seemed more

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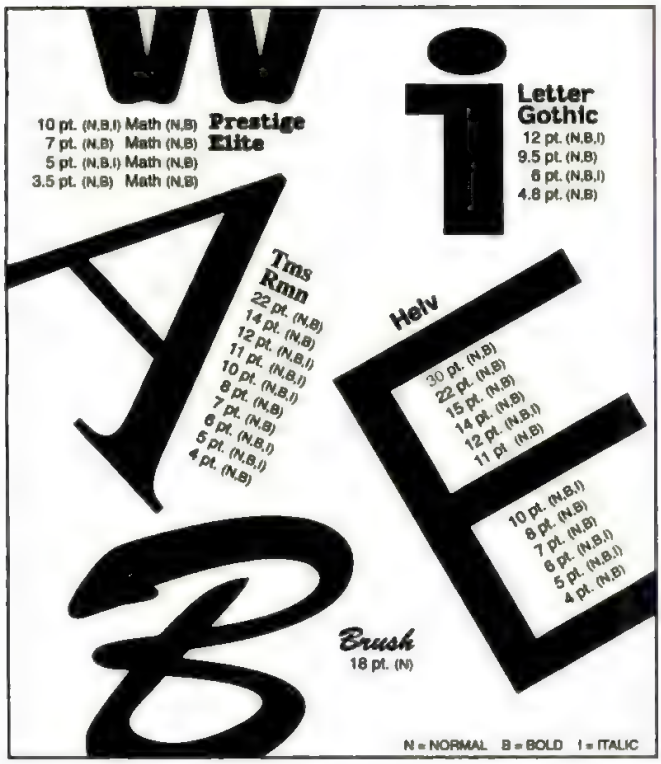

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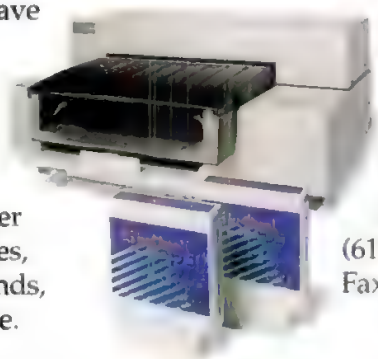

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reasonable to keep this information in numeric form rather than converting numbers to and from text strings.

Using the message and structure form of MCI involves two basic functions: mciSendCommand to pass messages and structures to MCI, and mciGetErrorString to report errors. The syntax for the mciSendCommand function is:

```
dwError = mciSendCommand
  (wDeviceID, wMsg, dwParam1,
  dwParam2) ;
```

The wDeviceID parameter is obtained when the device is first opened. The wMsg parameter is one of about 30 messages beginning with the prefix MCI defined in the MMSYSTEM.H header file, such as MCI_OPEN, MCI_PLAY and MCI_CLOSE. The dwParam1 parameter contains flags for the command, and dwParam2 is a far pointer to a data structure. Some 30 data structures are defined in MMSYSTEM.H; they begin with the prefix MCI and end with the suffix PARMS (MCI_OPEN_PARMS and MCI_PLAY_PARMS, for example). Some messages use the generic MCI_GENERIC_PARMS structure.

Near the beginning of the MIDPLA.C source code is a function called MciSend that encapsulates the mciSendCommand and mciGetErrorString functions. If mciSendCommand returns 0 (indicating that the function was successful), MciSend returns TRUE. If mciSendCommand returns an error code, the corresponding error string is obtained and displayed. MciSend then returns FALSE.

To further simplify using the MCI commands from the program, MIDPLA.C includes a number of functions and macros as well, each of which corresponds to an MCI command I use in the program. (I wanted to redefine all of MCI as functions in a C++ class, but it seemed a bit too ambitious a project to do correctly, so I took this simpler approach.)

Besides the dialog box procedure for MIDPLA's main window, the only other function in MIDPLA.C is UpdateLabels. This function updates much of the text information shown in the window, including the length of the MIDI file in whatever time format has been selected, the current position in the MIDI file, and the current tempo. The two scroll bars are also updated by this function to indicate the current position and tempo.

PLAYING THE MIDI FILE The five push buttons in MIDPLA's main window—Open, Play, Pause, Stop, and Close—correspond to what are probably the five most common MCI commands.

Pressing the Open button causes MIDPLA to call the GetOpenFileName function included in the Windows 3.1 common dialog box library. This displays a dialog box that lets you select a MIDI file to open. Windows 3.1 includes a MIDI file called CANYON.MID, which is convenient to try. (Unfortunately, the file is a particularly vapid example of "industry" music, so called because it's common in product announcements and other industry shows).

The program then attempts to open the file using the MCI_OPEN message. If successful, the window is initialized: The Song Pointer radio button is disabled for SMPTE files, and the range of the tempo scroll bar is set. The range is fixed at 20 to 480 quarter notes per minute for a PPQN file, and 5 to 120 frames per second for a SMPTE file.

Selecting the Play button causes MIDPLA to send the MCI_PLAY message to start the music. The MCI_NOTIFY flag is used so that the window procedure is notified when the file is finished playing. This is indicated by an MM_MCINOTIFY message with wParam equal to MCI_NOTIFY_SUCCESSFUL. To keep the position scroll bar updated, MIDPLA sets a windows timer. On receipt of WM_TIMER message, MIDPLA calls UpdateLabels.

At this point, the Pause and Stop buttons can be pressed. Although two different MCI messages are involved (MCI_PAUSE and MCI_STOP), they have basically the same effect. To resume playing, press the Play button.

The first scroll bar indicates the relative position in the file and can also be used to change the position, making use of the MCI_SEEK command. The scroll bar range is kept constant from 0 to 1,000. Therefore, the new position can be calcu-

MIDPLA.RC
Complete Listing

```
/*---------------------------
   MIDPLA.RC resource script
  ---------------------------*/

#include <windows.h>
#include "midpla.h"

#define GRP WS_GROUP
#define TSG WS_GROUP | WS_TABSTOP

MidPla DIALOG 12, 20, 270, 122
     CAPTION "MIDI File Player"
     STYLE DS_MODALFRAME | WS_POPUP | WS_CAPTION | WS_SYSMENU | WS_MINIMIZEBOX
     {
     PUSHBUTTON "Open",      ID_OPEN,      8,   8,  28,  14, GRP
     PUSHBUTTON "Play",      ID_PLAY,     44,   8,  28,  14, GRP | WS_DISABLED
     PUSHBUTTON "Pause",     ID_PAUSE,    80,   8,  28,  14, GRP | WS_DISABLED
     PUSHBUTTON "Stop",      ID_STOP,    116,   8,  28,  14, GRP | WS_DISABLED
     PUSHBUTTON "Close",     ID_CLOSE,   152,   8,  28,  14, GRP | WS_DISABLED

     LTEXT      "",          ID_POSBEG,   16,  42,  78,   8
     RTEXT      "",          ID_POSEND,   94,  42,  78,   8
     SCROLLBAR               ID_POSITION,  8,  50, 172,   9, WS_TABSTOP
     CTEXT      "Position",  ID_POSTEXT,   8,  62, 172,   8

     LTEXT      "",          ID_TMPMIN,   16,  86,  78,   8
     RTEXT      "",          ID_TMPMAX,   94,  86,  78,   8
     SCROLLBAR               ID_TEMPO,     8,  94, 172,   9, WS_TABSTOP
     CTEXT      "Tempo",     ID_TMPTEXT,   8, 106, 172,   8

     GROUPBOX     "Time Format",    -1,              188,   4,  74, 110
     RADIOBUTTON "Milliseconds",  ID_MILLISECS,    192,  18,  66,  12, TSG
     RADIOBUTTON "Song Pointer",  ID_SONGPTR,      192,  34,  66,  12
     RADIOBUTTON "SMPTE 24",      ID_SMPTE24,      192,  50,  66,  12
     RADIOBUTTON "SMPTE 25",      ID_SMPTE25,      192,  66,  66,  12
     RADIOBUTTON "SMPTE 30",      ID_SMPTE30,      192,  82,  66,  12
     RADIOBUTTON "SMPTE 30 Drop", ID_SMPTE30DF,    192,  98,  66,  12
     }
```

Figure 2: **This resource script defines the dialog template used as MIDPLA's main window.**

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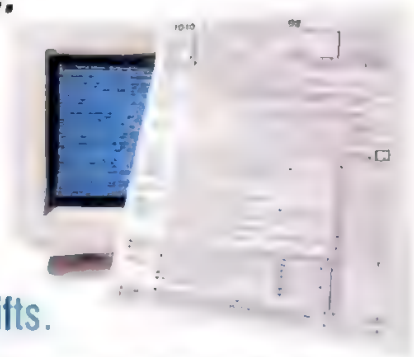

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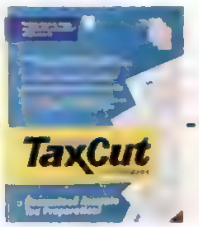

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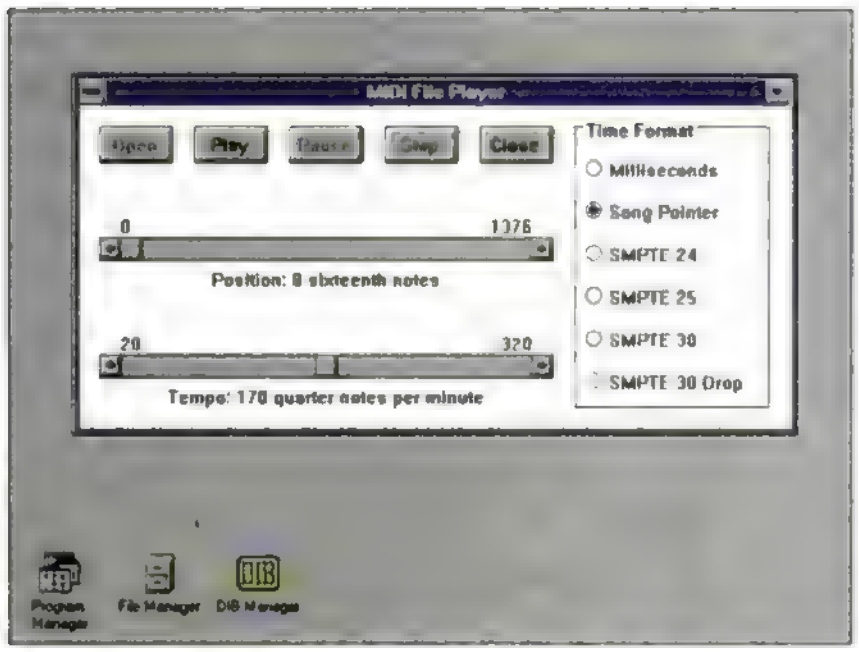

Figure 3: **This shows the MIDPLA program with a MIDI file opened, ready to play.**

lated as the scroll bar position times the length of the MIDI file divided by 1,000. To avoid complex calculations when the time format is SMPTE, the time format is temporarily switched to milliseconds for this calculation. (A similar temporary switch to the millisecond time format also occurs in UpdateLabels to set the position scroll bar.)

TIME FORMATS After a MIDI file has been opened, you can select a different time format at any time. The length and position values will change accordingly. For example, CANYON.MID is a PPQN file. The tempo is 170 quarter notes per minute. With the millisecond time format, the length is 121,363 milliseconds, or 2 minutes 1.363 seconds. Selecting the song pointer time format shows a length of 1,376 sixteenth notes. This corresponds to 344 quarter notes. Because the tempo is 170 quarter notes per minute, that makes the length of the composition 2 minutes 1.412 seconds—close enough, considering that the tempo of 170 is an integer approximation of the actual tempo stored in the file (which is 352,941 microseconds per quarter note).

If you select the SMPTE 24 time format (24 frames per second), the length of the file is given as 00:02:01:08, or minutes, second, and frames. For the SMPTE 25 format, it's 00:02:01:09, and for the SMPTE 30 format, the length is given as 00:02:01:10. The differing number of frames results from multiplying 0.363 (the number of seconds beyond 2 minutes 1 second) by 24, 25, and 30 frames per second and truncating.

TEMPO STRANGENESS You can dynamically change the tempo of the MIDI file as it's playing by manipulating the second scroll bar. Notice, however, that the length of the file as reported by MCI does not change, even though the music obviously plays at a slower or faster rate. There's a reason for this: The tempo of a MIDI file is governed by meta-events in the file and there may be several tempo meta-events located throughout the file. The music could be playing at one tempo for a while, and a second tempo meta-event could speed up the music.

While it's fairly straightforward for MCI to calculate the length of the MIDI file based on multiple tempo meta-events, what does it mean when the tempo is changed dynamically from an MCI command? Does it mean that this new tempo replaces only the tempo meta-event in effect at the time? Or will it replace future tempo meta-events?

To investigate this, I needed a MIDI file with at least two tempo meta-events. I couldn't find such a file in my own collection, so I decided to make one out of CANYON.MID. If you take the TEMPO.SCR script shown below

```
e 4150 00 FF 51 03 02 B1 56
n canyont.mid
w
q
```

and run DEBUG like so

```
DEBUG CANYON.MID < TEMPO.SCR
```

you can create CANYONT.MID, which has a second tempo meta-event embedded halfway through the file. This tempo meta-event plays the last half of the piece at double the speed.

When you load CANYONT.MID into MIDPLA, you'll see the length of the piece indicated as about 92 seconds rather than 121 seconds. About 63 seconds into the piece the tempo jumps from 170 to 340 quarter notes per minute. If you change the tempo using the scroll bar before this point, the tempo you set will be in effect only until MCI encounters the next tempo meta-event in the file.

So, we see that while it may be fun to change the tempo of a MIDI file as it's playing, this facility of MCI has only limited general use. It can't uniformly slow down or speed up a composition that contains multiple tempo meta-events.

EXPERIMENTING WITH SMPTE FILES I couldn't find any SMPTE files to test MIDPLA, so I used another DEBUG script, SMPTE.SCR, to create one:

```
e 10C E7 32
e 132 00 9C 40
n canyons.mid
w
q
```

Run it through DEBUG as follows

```
DEBUG CANYON.MID < SMPTE.SCR
```

to create CANYONS.MID, a SMPTE-based MIDI file. The first 2 bytes alter the header section to indicate a SMPTE 25 file with a division value of 50 (to approximate the tempo of the original). The other 3 bytes alter the tempo meta-event in CANYON.MID to give it 40,000 microseconds per frame—consistent with 25 frames per second.

When you load CANYONS.MID into MIDPLA, you'll see that it's reported as having a length of 00:02:12:02, or 132,096 milliseconds. These two values are consistent. The tempo is specified as 25 frames per second. Now change the time format—with the SMPTE 24 time format the length is indicated as 00:02:17:14. And with the SMPTE 30 time format, the length is indicated as 00:01:50:02, even though the composition will still play in 2 minutes 12 seconds. Just what is going on here?

Well, for SMPTE files, apparently MCI calculates the length without taking into account any tempo meta-events. This is reasonable, considering that tempo meta-events have no real place in a SMPTE file. When you set a different SMPTE time format for such a file, MCI reports the length of the composition as if that were the division type of the file. But the file is played at the tempo implied by the division type or indicated by a tempo meta-event.

COMING UP: MIDI FILE FORMAT If you've been dumping out CANYON.MID and attempting to figure out the MIDI file format, hold on for a bit. That will be the subject of the next issue's column. □

POWER PROGRAMMING

Exploring the WIN16, WIN32, and WIN32S APIs

BY RAY DUNCAN

Everyone agrees that OS/2 1.*x* was a flop, but there's little agreement about *why* it flopped. OS/2's bumpy history has been affected by a vast constellation of personalities, strategic decisions, and market forces both seen and invisible. IBM supporters feel that Microsoft contributed to OS/2's problems first by failing to commit itself wholeheartedly to OS/2 application and device driver development, and then by unilaterally abandoning the operating system when it became financially expedient to do so. Microsoft partisans, on the other hand, claim that IBM doomed OS/2 by insisting on a 286 version, by linking OS/2's destiny with the PS/2, and by inventing a new graphical API instead of simply porting Windows to protected mode and running it on top of the OS/2 kernel. There are those who see the last six years' events as evidence of sinister plots at IBM or Microsoft, and others who see the same events as healthy manifestations of a capitalist economy and a free market.

Clearly, there are no simple explanations for what went wrong, and nearly all of the proposed explanations for OS/2's problems are subject to various interpretations. For example, it's certainly fair to condemn Microsoft for reneging on its commitments to OS/2 developers two years ago when it decided to focus on Windows development. It's equally fair to criticize Microsoft for its decision three years earlier to embrace the new Presentation Manager (PM) API just to gain IBM's endorsement, leaving Windows developers (both inside and outside Microsoft) to twist slowly in the wind. If there's a lesson to be learned here, it's that developers of any stripe need to be wary, because Microsoft never learned how to set long-range goals and then stick to them through good times and bad.

In any event, at least one of the OS/2 theories is about to be publicly tested—the premise that the OS/2 1.*x* PM API was "too big a delta" from the Windows 2.*x* API, that developers couldn't handle the transition, and that consequently OS/2 suffered from a lack of pull-through demand generated by hypothetical killer applications.

Despite the move toward a 32-bit environment, the 16-bit Windows 3.1 API will likely be secure for some time, making code portability increasingly important.

The whole scenario is about to be played out again for 32-bit apps, only the playing field is somewhat more level. The stable retail version of OS/2 2.0, along with a complete set of development tools, is already in the hands of tens of thousands of developers, some of whom have been subsidized by IBM to the tune of millions of dollars to generate shrink-wrapped OS/2 applications. OS/2 2.0 is being pitted against Microsoft's NT (New Technology) operating system and its WIN32 API, which first reached selected developers in fall 1991 and became broadly available to programmers in July 1992. The results of the test will be easy to evaluate. If, in spite of OS/2 2.0's head start, IBM feels obligated to add WIN32 support to a subsequent version of OS/2 in order to maintain the system's viability, we will know that the API issue was in fact a crucial one.

WIN16, WIN32, and WIN32S The whole concept of the WIN32 API has caused tremendous confusion among industry columnists and observers. Traditionally, the gold standard for a personal computer operating system API has been a particular *delivered version* of that operating system, that is, *what it does,* rather than the documentation (which was often incomplete, severely delayed, or downright misleading). When the behavior of the operating system and its documentation disagreed, the system itself always prevailed.

By contrast, the WIN32 API first arrived during early 1991 as a specification document—unaccompanied (and untainted) by any attempt at a real-world implementation. The specification drove the construction of the system, rather than being written as an afterthought. It's worth taking a few minutes now to clarify exactly how WIN32 and its cousin, WIN32S, are related to the Windows 3.*x* API.

For convenience, let's refer to the Windows 3.1 16-bit API—which includes the new functions for DDE (Dynamic Data Exchange), drag-and-drop, multimedia, common dialogs, and OLE (Object Linking and Embedding)—as the WIN16 API. This API reached its present configuration through a process of accretion; it is almost laughably asymmetric and contains a great many redundant or overlapping functions. It seems likely that the rich, complex, and wacky WIN16 API will be secure for several years—if for no other reason than that its object-oriented successor (called Windows Cairo by Microsoft) will be even more

hideously complex and will inevitably be subject to many unforseen development delays and a lengthy beta test cycle.

WIN32 is an almost pure 32-bit superset of WIN16. In other words, for essentially every hardware-independent function in WIN16, there exists a function in WIN32 that has the same calling syntax and the same semantics. Because WIN32 is a superset of WIN16, though, WIN32 also includes many functions that don't exist in WIN16. These functions are designed to position WIN32 as a credible competitor to UNIX and the 32-bit OS/2 Presentation Manager API; they include support for security, networking, memory-mapped files, preemptive multitasking, threads, symmetric multiprocessing, Named Pipes, mailslots, semaphores, and advanced graphics engine capabilities such as paths, transforms, and Bezier curves.

The WIN32 API has been implemented initially on top of Microsoft's NT operating system. NT was written by a team led by ex-Digital Equipment Corp. operating system guru David Cutler, and its microkernel architecture is similar to Mach (a variant of Unix used on the NeXT computer). As I write this, NT/WIN32 is running on Intel 80386/486 and MIPS processors, and will soon be available for Digital's Alpha processor as well. Microsoft has also promised that WIN32 will be implemented on top of a "future version of DOS," though the company has been rather vague about the time frame.

Where does WIN32S fit into this picture? Apparently, WIN32S is Microsoft's attempt to counter widespread fears that NT will be too expensive, too powerful, and too resource-hungry for the average desktop machine. The *S* in WIN32S stands for subset: the WIN32S API consists of all the WIN32 functions—and only the WIN32 functions—that have direct counterparts in WIN16. WIN32S applications will be true 32-bit protected-mode applications, but with a crucial advantage over full-fledged WIN32 applications: The same binaries will run on either Windows 3.*x* or NT/WIN32 systems.

On an NT/WIN32 platform, a WIN32S application will not take advantage of all the NT capabilities, but it will benefit from NT's flat memory model, 32-bit graphics engine, and improved file system. On a Windows 3.*x* platform, each function call by the WIN32S application will be trapped by a translation layer in a DLL or Virtual Device Driver (VxD) and remapped into an ordinary WIN16 function call. The performance of WIN32S applications running under Windows 3.*x* will be throttled by the WIN16 graphics engine, but the ability to run on Windows 3.*x* will increase the short-term market for WIN32S applications dramatically, and should provide powerful motivation for developers to migrate their Windows programs from 16

WINAPP.C

1 of 2

```
// WINAPP - WIN16 and WIN32 Portable Application Skeleton
// Copyright (C) 1992 Ray Duncan
// PC Magazine * Ziff Davis Publishing

#define dim(x) (sizeof(x) / sizeof(x[0]))   // returns no. of elements

#include "windows.h"
#include "winapp.h"

HANDLE hInst;                               // module instance handle
HWND hFrame;                                // handle for frame window

char szShortAppName[] = "WinApp";           // short application name
char szAppName[] = "Windows Demo App";      // long application name
char szMenuName[] = "WinAppMenu";           // name of menu resource
char szIconName[] = "WinAppIcon";           // name of icon resource

//
// Table of window messages supported by FrameWndProc()
// and the functions which correspond to each message.
//
struct decodeUINT messages[] = {
    WM_PAINT, DoPaint,
    WM_COMMAND, DoCommand,
    WM_DESTROY, DoDestroy, } ;

//
// Table of menubar item IDs and their corresponding functions.
//
struct decodeUINT menuitems[] = {
    IDM_EXIT, DoMenuExit,
    IDM_ABOUT, DoMenuAbout, } ;

//
// WinMain -- entry point for this application from Windows.
//
INT APIENTRY WinMain(HANDLE hInstance,
    HANDLE hPrevInstance, LPSTR lpCmdLine, INT nCmdShow)
{
    MSG msg;

    hInst = hInstance;                      // save this instance handle

    if(!hPrevInstance)                      // if first instance,
        if(!InitApp(hInstance))             // register window class
            return(FALSE);                  // exit if couldn't register

    if(!InitInstance(hInstance, nCmdShow))  // create this instance's window
        return(FALSE);                      // exit if create failed

    while(GetMessage(&msg, NULL, 0, 0))     // while message != WM_QUIT
    {
        TranslateMessage(&msg);             // translate virtual key codes
        DispatchMessage(&msg);              // dispatch message to window
    }

    TermInstance(hInstance);                // clean up for this instance
    return(msg.wParam);                     // return code = WM_QUIT value
}

//
// InitApp --- global initialization code for this application.
//
BOOL InitApp(HANDLE hInstance)
{
    WNDCLASS  wc;

    // set parameters for frame window class
    wc.style = CS_HREDRAW|CS_VREDRAW;       // class style
    wc.lpfnWndProc = FrameWndProc;          // class callback function
    wc.cbClsExtra = 0;                      // extra per-class data
    wc.cbWndExtra = 0;                      // extra per-window data
    wc.hInstance = hInstance;               // handle of class owner
    wc.hIcon = LoadIcon(hInst, szIconName); // application icon
    wc.hCursor = LoadCursor(NULL, IDC_ARROW);       // default cursor
    wc.hbrBackground = GetStockObject(WHITE_BRUSH); // background color
    wc.lpszMenuName =  szMenuName;          // name of menu resource
    wc.lpszClassName = szShortAppName;      // name of window class

    return(RegisterClass(&wc));             //register class, return status
}

//
// InitInstance --- instance initialization code for this application.
//
BOOL InitInstance(HANDLE hInstance, INT nCmdShow)
{
    hFrame = CreateWindow(                  // create frame window
        szShortAppName,                     // window class name
        szAppName,                          // text for title bar
        WS_OVERLAPPEDWINDOW,                // window style
        CW_USEDEFAULT, CW_USEDEFAULT,       // default position
        CW_USEDEFAULT, CW_USEDEFAULT,       // default size
        NULL,                               // no parent window
        NULL,                               // use class default menu
        hInstance,                          // window owner
        NULL);                              // unused pointer

    if(!hFrame) return(FALSE);              // error, can't create window

    ShowWindow(hFrame, nCmdShow);           // make frame window visible
    UpdateWindow(hFrame);                   // force WM_PAINT message
    return(TRUE);                           // return success flag
}

//
// TermInstance -- instance termination code for this application.
//
BOOL TermInstance(HANDLE hinstance)
{
```

Figure 1: **This is the source code for the skeleton program that can be compiled for either WIN16 or WIN32.**

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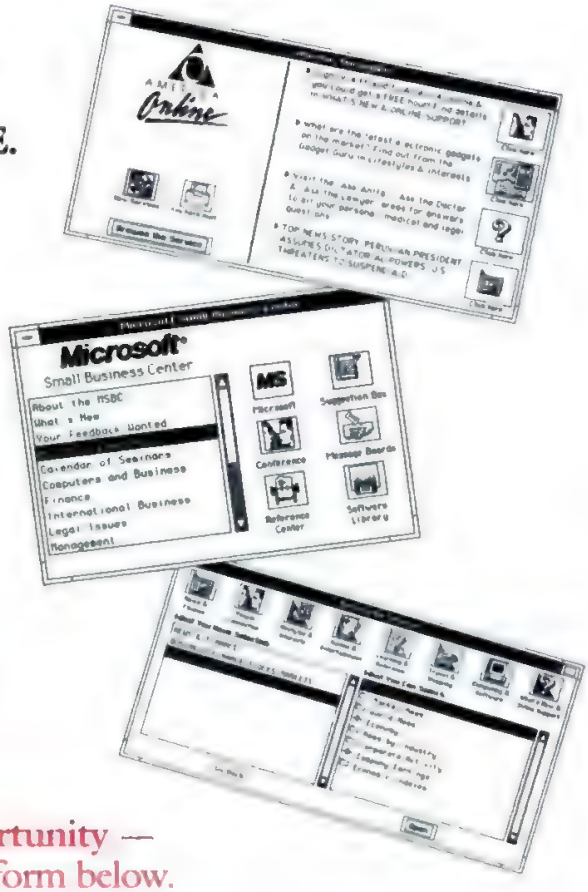

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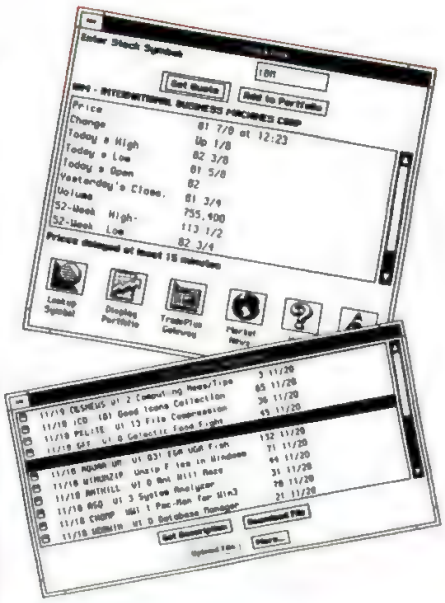

WINAPP.C

2 of 2

```
    return(TRUE);                           // return success flag
}

//
// FrameWndProc --- callback function for application frame window.
//
LONG FAR APIENTRY FrameWndProc(HWND hWnd, UINT wMsg, UINT wParam, LONG lParam)
{
    INT i;                                  // scratch variable

    for(i = 0; i < dim(messages); i++)      // decode window message and
    {                                       // run corresponding function
        if(wMsg == messages[i].Code)
            return((*messages[i].Fxn)(hWnd, wMsg, wParam, lParam));
    }
                                            // or hand off to Windows
    return(DefWindowProc(hWnd, wMsg, wParam, lParam));
}

//
// DoCommand -- process WM_COMMAND message for frame window by
// decoding the menubar item with the menuitems[] array, then
// running the corresponding function to process the command.
//
LONG DoCommand(HWND hWnd, UINT wMsg, UINT wParam, LONG lParam)
{
    INT i;                                  // scratch variable

    for(i = 0; i < dim(menuitems); i++)     // decode menu command and
    {                                       // run corresponding function
        if(wParam == menuitems[i].Code)
            return((*menuitems[i].Fxn)(hWnd, wMsg, wParam, lParam));
    }

    return(DefWindowProc(hWnd, wMsg, wParam, lParam));
}

//
// DoDestroy -- process WM_DESTROY message for frame window.
//
LONG DoDestroy(HWND hWnd, UINT wMsg, UINT wParam, LONG lParam)
{
    PostQuitMessage(0);                     // force WM_QUIT message to
    return(0);                              // terminate the event loop
}

//
// DoPaint -- process WM_PAINT message for frame window.
//
LONG DoPaint(HWND hWnd, UINT wMsg, UINT wParam, LONG lParam)
{
    HDC hdc;
    PAINTSTRUCT ps;
    RECT rect;
    HFONT hfont;

    hdc = BeginPaint(hWnd, &ps);            // get device context
    GetClientRect(hWnd, &rect);             // get client area dimensions
    hfont = CreateFont(-36, 0, 0, 0, 700,   // get handle for pretty font
        TRUE, 0, 0, ANSI_CHARSET,
        OUT_DEFAULT_PRECIS, CLIP_DEFAULT_PRECIS,
        DEFAULT_QUALITY, (FF_MODERN << 4) + DEFAULT_PITCH,
        "Ariel");
    SelectObject(hdc, hfont);               // realize font in DC
    DrawText(hdc, "Hey, Dude!", -1,         // paint text in window
        &rect, DT_CENTER | DT_VCENTER | DT_SINGLELINE);
    EndPaint(hWnd, &ps);                    // release device context
    return(0);                              // terminate the event loop
}

//
// DoMenuExit -- process File-Exit command from menu bar.
//
LONG DoMenuExit(HWND hWnd, UINT wMsg, UINT wParam, LONG lParam)
{
    SendMessage (hWnd, WM_CLOSE, 0, 0L);    // send window close message
    return(0);                              // to shut down the app
}

//
// DoMenuAbout -- process File-About command from menu bar.
//
LONG DoMenuAbout(HWND hWnd, UINT wMsg, UINT wParam, LONG lParam)
{
    WNDPROC lpProcAbout;                    // scratch far pointer

    lpProcAbout = MakeProcInstance((WNDPROC)AboutDlgProc, hInst);
    DialogBox(hInst, "AboutBox", hWnd, lpProcAbout);
    FreeProcInstance(lpProcAbout);
    return(0);
}

//
// AboutDlgProc -- callback routine for About... dialog
//
BOOL FAR APIENTRY AboutDlgProc (HWND hwnd, UINT msg, UINT wParam, LONG lParam)
{
    if((msg == WM_COMMAND) && (wParam == IDOK))
        EndDialog(hwnd, 0);
    else
        return(FALSE);
}
```

bits to 32 bits.

HOW BIG THE GAP? In the introduction to the *WIN32 Programmer's Reference Manual,* Volume I (Microsoft Press, 1991), Microsoft lists six general goals for the WIN32 API. The first two of these goals are to provide a 32-bit migration path for existing Windows applications and to make porting a Windows application to WIN32 as easy as possible. How completely has Microsoft achieved these goals? The same manual recounts "[The Windows 3.1] File Manager contains 20,000 lines of code; yet within one day, it was compiling as a native WIN32 application. Within a week, File Manager could execute and display directory listings." I don't find this to be an incredible feat at all; in fact, the admission that it took a whole week to get File Manager to execute as a WIN32 application makes reasonable the assumption that the original File Manager was very sloppily coded. In my own experience, clean Windows 3.*x* application code can be mechanically edited for WIN32 and will usually compile and run on WIN32 the very first time. The application code may not work entirely *correctly* the first time, but it will do something, and the trouble spots are normally quite obvious.

More importantly, if you study the WIN16 and WIN32 APIs carefully before writing your application, it's quite feasible to compile both WIN16 and WIN32 binaries from the exact same source code base. In fact, if you're willing to sacrifice the function calls that are unique to NT/WIN32—in other words, to settle for a WIN32S application instead of a full-fledged WIN32 application—you can readily hide all the differences between the two APIs with conditional compilation and #defines in the application's header files. All this certainly bodes well for the early availability of mainstream applications on NT/WIN32, and in fact Microsoft demonstrated Excel 3.0 running as a native WIN32 app before most Windows developers had even heard of WIN32. Let's take a minute to look at some of the differences between WIN16 and WIN32 that have to be provided for in the header file of such a "dual-targeted" application.

The most obvious discrepancy between the two APIs is that WIN16 was built for the Intel 80x86 segment architecture, while WIN32 was designed for the 32-bit flat memory model typical of the Intel 80386/486 running in paged virtual memory mode, the Motorola 680x0 family, and the RISC processors. Thus, the segment:offset *far* pointers of the WIN16 API become 32-bit *near* offsets in WIN32. Microsoft's 32-bit C compiler treats the FAR keyword essentially as a NOOP, and large-model WIN16 code (which doesn't attempt to take advantage of "magical" knowledge about the contents of a far pointer) will usually compile without changes for WIN32—though it will execute much more efficiently. Similarly, application callback functions are entered via near calls instead of far pascal calls in WIN32. The two calling conventions can easily be hidden within conditional #defines and made transparent to

WINAPP.H
Complete Listing

```
//
// WINAPP.H -- Header File for Demo Program WINAPP.C
//

#if !defined(WIN32)

  #define WIN16      TRUE
  #define WIN31

  #define INT        int
  #define UINT       WORD
  #define APIENTRY   PASCAL
  #define WNDPROC    FARPROC

#else

  #define WIN16      FALSE

#endif

struct decodeUINT {                          // structure associates
    UINT Code;                               // messages or menu IDs
    LONG (*Fxn)(HWND, UINT, UINT, LONG); }; // with a function

#define     IDM_EXIT     100
#define     IDM_ABOUT    101

// Function prototypes
INT APIENTRY WinMain(HANDLE, HANDLE, LPSTR, INT);
BOOL InitApp(HANDLE);
BOOL InitInstance(HANDLE, INT);
BOOL TermInstance(HANDLE);
LONG FAR APIENTRY FrameWndProc(HWND, UINT, UINT, LONG);
BOOL FAR APIENTRY AboutDlgProc (HWND, UINT, UINT, LONG);
LONG DoDestroy(HWND, UINT, UINT, LONG);
LONG DoPaint(HWND, UINT, UINT, LONG);
LONG DoCommand(HWND, UINT, UINT, LONG);
LONG DoMenuExit(HWND, UINT, UINT, LONG);
LONG DoMenuAbout(HWND, UINT, UINT, LONG);
```

Figure 2: **The #define statements in this header file supplement the WINDOWS.H header file to mask the differences between WIN16 and WIN32.**

a well-behaved application at both compile time and runtime.

Another point of divergence between WIN16 and WIN32 is that an integer in WIN16 code is, logically enough, 16 bits wide, while an integer in WIN32 is 32 bits wide. A "short" value, on the other hand, remains 16 bits in both systems and a "long" is likewise 32 bits in both systems. This means you must be very careful about using the proper data types for handles, logical and device coordinates, and other values that are defined as signed or unsigned integers in the WIN16 API, since these are all widened to 32-bits in the WIN32 API. For example, I often see Windows source code that declares parameters as WORD when they should be unsigned integers (UINT), or vice versa. When compiling 16-bit code, these data types are equivalent, but improperly specifying a WORD (16 bits) instead of UINT (32 bits) in WIN32 code will yield a compilation error if you're lucky, or a crash at execution time if you're not.

The third potential trouble spot—no, make that a *definite* trouble spot—is Windows messages. Windows applications are event-driven, and the events are represented as message packets that are posted to the application's message queue. The application responds to an event by reading a message from its queue and processing it; if the queue is empty, the application yields control of the system until a message arrives. A WIN16 message packet has four components: a 16-bit handle for the window that is to receive the message, a 16-bit message number (the possible values are defined in the Windows SDK header file as names of the form WM_xxxx), a 16-bit parameter called wParam, and a 32-bit parameter called lParam. In a WIN32 message packet, the four components have the same general usage, but all four are the same length: 32-bits.

Unfortunately, in the WIN16 API, certain messages used half of lParam for a handle of some type, and the remaining half of lParam for other data. Since WIN32 handles are 32 bits, such message packets obviously must be redefined for WIN32, usually by moving the "other" data from lParam to the upper or lower half of the widened wParam. Once you know about them, differences in message formats can be hidden by trivial conditional #defines in the header file, but the mutation of many important message packets is the main reason why newly ported WIN32 apps often only "sort of work" on first try after a clean compile.

This problem with message packets was really completely unnecessary. If Microsoft had elected to double the size of lParam along with everything else in

WINAPP.DEF
Complete Listing

```
NAME        WinApp

DESCRIPTION  'WinApp - Demonstration Windows Application'

EXETYPE       WINDOWS

STUB        'WINSTUB.EXE'

CODE        PRELOAD MOVEABLE
DATA        PRELOAD MOVEABLE MULTIPLE

HEAPSIZE      32768
STACKSIZE     8192

EXPORTS
  FrameWndProc
  AboutDlgProc
```

Figure 3: **This is the module definition file for the WINAPP program.**

the message packet, no redefinition of message formats would have been needed, and one of the few significant aggravations involved with porting applications to WIN32 would have been prevented. The decision to leave the size of lParam at 32-bits in WIN32 was predestined back when CL386 was being thrown together for the first OS/2 2.0 SDK. Ignoring history, Microsoft's languages division decreed that there was no need for their compiler to support true "longs" that were twice the size of a 32-bit integer because a 32-bit address or value was big enough for any app they could imagine. Less than four years later, with the very first prerelease version of NT/WIN32 running on a true 64-bit microprocessor (the MIPS R4000), I can't help but wonder whether those worthy language developers are still employed.

You've probably been wondering when I'd get around to talking about inconsistencies between the WIN16 and WIN32 APIs proper. The truth is, the glitches you'll encounter in this area will be extremely rare. In both WIN16 and WIN32, the same functions do the same things with the same side effects and they use the same parameters. If structures are passed to or received from the functions, the elements of the structures have the same names and the same meanings. The one API-related circumstance that may cause some confusion occurs when the compiler generates error messages that refer to apparently nonexistent function parameters. What's almost always happening in such cases is that the function you think you're using is being remapped by a macro in the WIN32 header file to another (more general) function, and the parameters are being rearranged. Thus, for example, an invocation of CreateWindow() in your source code is silently remapped to a call to CreateWindowEx().

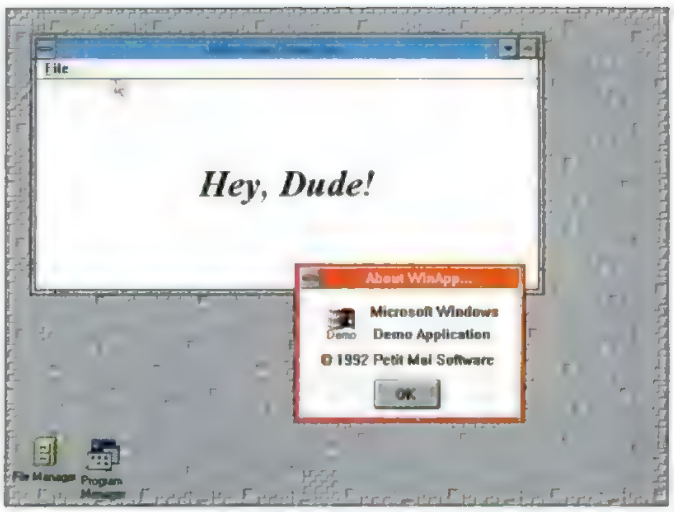

Figure 5: This is a screen shot of the WINAPP program. Can you guess whether it's running under Windows 3.x or NT/WIN32?

A PORTABLE APP SKELETON We will be discussing the WIN16, WIN32, and OS/2 PM APIs in more detail in upcoming columns, with particular attention to code portability. To give you some initial feeling for the similarities between the WIN16 and WIN32 APIs, however, I've written a skeleton application called WINAPP that can be compiled without changes for Windows 3.1 using Borland C++ 3.x or for NT/WIN32 with Microsoft's CL386. The source code for WINAPP can be found in Figure 1, the header file in Figure 2, the module definition file in Figure 3, the resource script in Figure 4, and a screenshot of WINAPP in action in Figure 5. All of these source files can be downloaded from PC MagNet. Or, if you don't have access to PC MagNet, you can get the files on-disk by sending a postcard with your name, address, and preferred floppy disk size to Katherine West, Power Programming, *PC Magazine*, One Park Ave., New York, NY 10016.

WINAPP is just a toy program of the "Hello World" genre, but it knows how to carry out almost all of the fundamental tasks of a Windows application. It processes messages, decodes menu commands, selects a font, paints in its window, and has a dialog box. The modularity and maintainability of the program is enhanced by use of the same table-driven message dispatcher that we previously saw in the DLGDEMO and SYSMON programs. You can use the WINAPP program as a starting point for much more elaborate applications that will run happily in either 16-bit or 32-bit mode; I've been doing it for quite a few months now, and you'll see some of the results in the next few issues.

THE IN-BOX Please send your questions, comments, and suggestions to me at any of these electronic mail addresses:
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WINAPP.RC
Complete Listing

```
// Resource script for WINAPP.C

#include "windows.h"
#include "winapp.h"

WinAppIcon ICON winapp.ico

WinAppMenu MENU
BEGIN
    POPUP           "&File"
    BEGIN
        MENUITEM    "E&xit",    IDM_EXIT
        MENUITEM    SEPARATOR
        MENUITEM    "A&bout",   IDM_ABOUT
    END
END

AboutBox DIALOG 23, 19, 106, 61
CAPTION "About WinApp..."
STYLE DS_MODALFRAME | WS_CAPTION | WS_SYSMENU
BEGIN
    ICON "WinAppIcon", -1, 12, 9, 16, 16, WS_CHILD | WS_VISIBLE
    CTEXT "Microsoft Windows", -1, 33, 7, 64, 8
    CTEXT "Demo Application", -1, 30, 18, 68, 9
    CTEXT "\251 1992 Petit Mal Software", -1, 9, 30, 87, 9
    CONTROL "OK", IDOK, "BUTTON", WS_GROUP, 36, 43, 32, 14
END
```

Figure 4: This is the resource script for the WINAPP program.

DATABASES

Conditions in Calculated Fields: How to simulate IF statements in Paradox reports and forms.

BY SAL RICCIARDI

Conditions in Calculated Fields

Although Paradox Application Language (PAL) is mainly for developing scripts and applications, you can also use many of PAL's functions in calculated fields, which can be inserted directly into reports and forms. Sometimes you can use calculated fields in not-so-obvious ways. For example, one of my reports requires that a secondary field be substituted if the primary field is blank. To handle this requirement, I created the following expression for a Paradox calculated field:

```
[pr] + SUBSTR( [secondary], 1,
(1-LEN([pr])) * LEN([secondary]))
```

I also used this "pseudo IF statement" approach to print an X if a field is nonblank:

```
SUBSTR("X", 1, LEN([field]))
```

and also to print an X only if a date is this year or later:

```
SUBSTR("X", 1,
1 + YEAR([field]) - YEAR(TODAY()))
```

I have used this approach successfully with several languages that did not provide decision logic (IF), but do provide functions.

Jon E. Pearkins
Ardrossan, Alberta, Canada

▶**PC MAGAZINE** You can simulate IF-THEN decision logic in reports and forms by mastering the subtleties of the SUBSTR() function and applying that knowledge in your calculated field formulas. This lets you avoid using full-blown PAL scripts for reports that require conditional logic.

In a moment, we'll dissect Mr. Pearkins's examples to see how they work. But first, let's review the SUBSTR() function. The purpose of this function is to extract and return a portion of a string (a substring). The function accepts three parameters. The first is the source string, the second is the starting position within the source string, and the third is the number of characters to return. For example,

You can simulate IF-THEN decision logic in reports and forms by mastering the subtleties of SUBSTR() and using it in calculated-field formulas.

```
SUBSTR("Sal", 1, 2)
```

says: Starting at the first position, return the next two characters from "Sal". The string returned is "Sa".

There are some interesting properties of the SUBSTR() function. All three parameters can accept nonsense. That is, the source string can be null, the start position can be negative, and the length can be negative (or 0), all without Paradox generating an error.

When the SUBSTR() function is called with a length parameter that is negative or 0, the function returns nothing. It is this property that makes Mr. Pearkins's techniques possible. Basically, you simulate an IF-ELSE construct by using the fact that SUBSTR() *does* return something when the length is positive, but returns *nothing* when the length is negative or 0.

Now for the examples. In the first one, the secondary field should be substituted if the primary field is blank:

```
[pr] + SUBSTR( [secondary], 1,
(1-LEN([pr])) * LEN([secondary]))
```

Suppose the primary field is blank and the secondary field contains "Sal". Since the primary field (represented by [pr]) is blank, the first part of the expression is empty. That leaves the SUBSTR() function. Since the primary field is empty, LEN([pr]) is 0. So, the first part of the length expression, (1-LEN([pr]), becomes (1-0), or 1, and the SUBSTR() becomes

```
SUBSTR("Sal", 1, 1 * LEN("Sal"))
```

Since LEN("Sal") is 3, we're left with

```
SUBSTR("Sal", 1, 3)
```

or "Sal". In this way, the secondary field is substituted if the primary field is empty.

Now let's consider what would happen if the primary field did contain something. Let's say it contains "Connie". In that case, our expression looks like

```
"Connie" + SUBSTR("Sal", 1,
(1 - LEN("Connie")) * LEN("Sal"))
```

Since the length of "Connie" is 6 characters and the length of "Sal" is 3, we're left with

```
"Connie" + SUBSTR("Sal", 1,
(1 - 6) * 3)
```

or

```
"Connie" + SUBSTR("Sal", 1, -15)
```

Since the SUBSTR() function doesn't return anything at all when the length parameter is negative (-15 in this case), you get an end result of the primary field alone: "Connie". With this method, if the primary field exists, only that field will be displayed.

An interesting property of the SUBSTR() function is that all three of its parameters can accept nonsense, without Paradox generating an error.

The second example is much simpler than the first:

```
SUBSTR("X", 1, LEN([field]))
```

Note that in this case, X appears only if the field exists, since that's the only time LEN([field]) is nonzero. If the field does not exist, the SUBSTR() statement amounts to "Return a portion of X starting with position 1 and continuing for 0 characters." In other words, return nothing.

In the third example, the length expression will be negative for all dates that have a year before the current year; consequently the X will not print for those years. □

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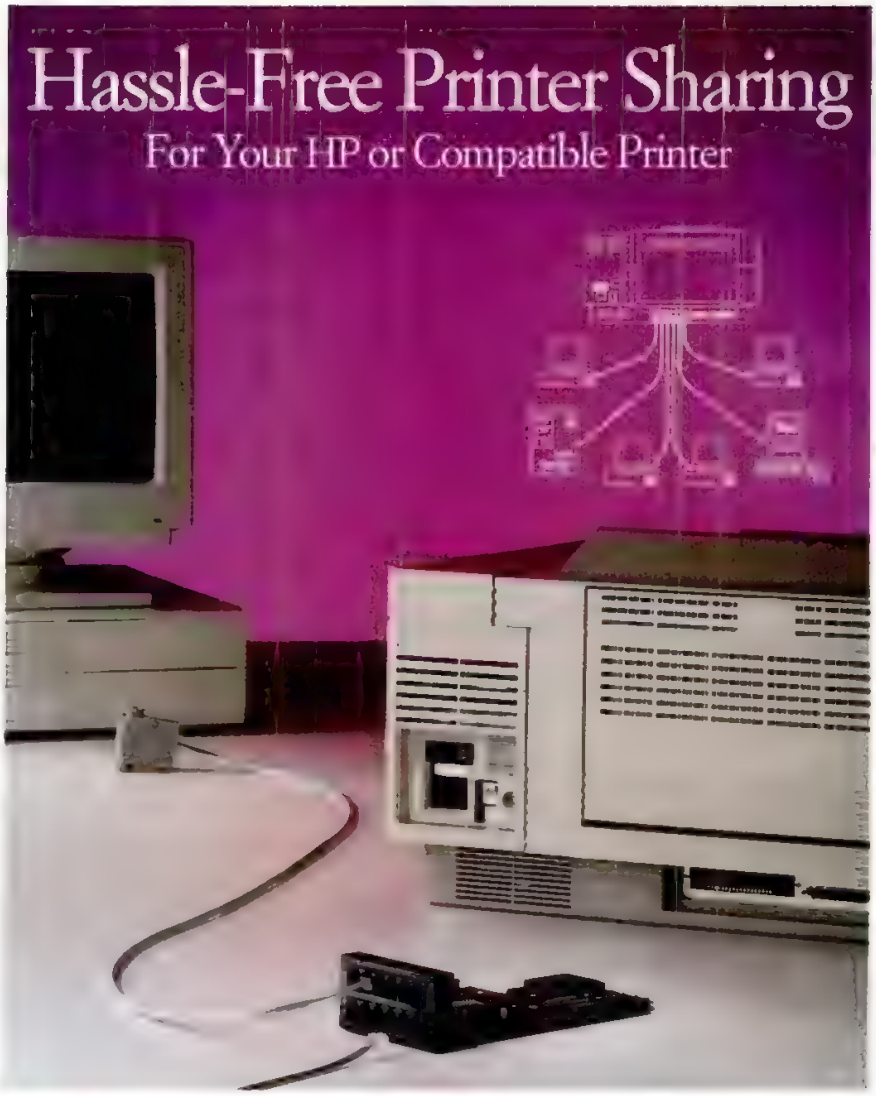

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CIRCLE 008 ON READER SERVICE CARD

Tracking File Versions: Here's a Turbo Pascal utility that will automatically add version numbers to your filenames.

EDITED BY SHARON TERDEMAN

Tracking File Versions

It's often necessary to retain several versions of a file. One way I keep track of multiple versions of any file is to name them with the extensions 001 through 999 (for example, I use the filenames MYFILE.001, MYFILE.002, and so on). I do this with the Turbo Pascal program RENVER, shown in Figure 1. Here's how to use the program

```
RENVER [path] file1 [file2]
```

where the parameters are as follows:

- *path* is the path to *file1*; the default is the current directory.
- *file1* is the file to rename.
- *file2* is the new name (not including the path or the extension) for the file; the default is *file1*'s filename without the extension.

RENVER searches the path containing *file1* for *file2.nnn*, seeking the largest version number *nnn* (*nnn* is set to 0 if no file exists as *file2.nnn*). The program then shells out to DOS to rename *file1* to *file2.nnn*+1. For example,

```
RENVER MYFILE.TMP
```

RENVER.PAS

Complete Listing

```
PROGRAM renver;
USES Dos;
VAR
  f1Path, f2Path : pathStr;
  f1Dir,  f2Dir  : dirStr;
  f1Name, f2Name : nameStr;
  f1Ext,  f2Ext  : extStr;
  f              : File;
  version        : Integer;
  verStr         : String;

  PROCEDURE doHelp;
  { Display help. }
  BEGIN
    WriteLn('Rename file file1 to file2.nnn, where ',
            'nnn is the latest version');
    WriteLn('from 001 through 999.');
    WriteLn;
    WriteLn('Usage: renver [path]file1 [file2]');
    WriteLn;
    WriteLn('  path      Path to file1. Default = ',
            'current directory');
    WriteLn;
    WriteLn('  file1     File to rename');
    WriteLn;
    WriteLn('  file2     New name (no path or ',
            'extension) for file');
    WriteLn('            Default = file1 less extension.');
    WriteLn;
    WriteLn('The path containing file1 is searched for ',
            'file2.nnn for the');
    WriteLn('largest version number nnn.  If no file ',
            'exists as file2.nnn, file1 is');
    WriteLn('renamed to file2.001, otherwise file1 is renamed ',
            'to file2.nnn+1.');
    WriteLn;
    WriteLn('E.g.   renver myfile.tmp');
    WriteLn;
    WriteLn('renames myfile.tmp to myfile.003 if ',
            'the last myfile.nnn is myfile.002.');
  END;

  FUNCTION init : Boolean;
  { Get file names from command line.
    Return false if neither exists. }
  BEGIN
    init := FALSE;
    IF ParamCount = 0 THEN Exit;
    f1Path := paramStr(1);
    f2Path := paramStr(2);
    if f2Path = '' then f2Path := f1Path;
    init := TRUE;
  END;

  FUNCTION maxVersion (fPath : pathStr): integer;
  { Find max version nnn.  Return 0 if no
    file exists as file.nnn. }
  VAR
    fDir  : dirStr;
    fName : nameStr;
    fExt  : extStr;
    fRec  : searchRec;
    maxVer, ver, err : integer;
  BEGIN
    maxVer := 0;
    fSplit(fPath, fDir, fName, fExt);
    fPath := fDir + fName + '.*';
    findFirst (fPath, AnyFile, fRec);
    WHILE dosError = 0 DO
      BEGIN
        fSplit(fRec.name, fDir, fName, fExt);
        {strip period. }
        fExt := copy(fExt, 2, length(fExt) - 1);
        val(fExt, ver, err);
        IF err = 0 THEN
          IF ver > maxVer THEN maxVer := ver;
        findNext(fRec);
      END { while };
    maxVersion := maxVer;
  END;

BEGIN
  IF init THEN
    BEGIN
      fSplit(f1Path, f1Dir, f1Name, f1Ext);
      fSplit(f2Path, f2Dir, f2Name, f2Ext);
      f2Path := f1Dir + f2Name;
      version := maxVersion(f2Path) + 1;
      {- wrap 999 to 1 -}
      IF version > 999 THEN version := 1;
      {- add 1000 to get 4 digits ... -}
      str(version + 1000, verStr);
      {- then keep last three -}
      delete(verStr, 1, length(verStr) - 3);
      WriteLn('rename ' + f1Path + ' ' +
        f2Name + '.' + verStr);
      Assign(F, f1Path);
      {$I-}Reset(F);{$I+}
      IF IOresult <> 0 THEN
        WriteLn(G,'File ', f1Path,' does not exist.')
      ELSE
        BEGIN
          Close(F);
          Rename(F, f2Name + '.' + verStr);
        END;
    END
  ELSE doHelp;
END.
```

Figure 1: **This clever utility renames a file to use the first numeric extension that's not already in use.**

renames MYFILE.TMP to MYFILE.003 if the last MYFILE.*nnn* happens to be MYFILE.002.

Among other uses, I find it convenient to name letters after their addressees and just use the RENVER utility to add version numbers to continue the series (for instance, MARY.001, MARY.002, and so on).

This clever little utility will endear itself to anyone who is familiar with an operating system that maintains multiple file versions.

I wonder when we'll see PC file systems with file versions or cycle numbers like those found on mainframes and minicomputers.

Stephen Chow
Minneapolis, Minnesota

▶**PC MAGAZINE** This clever little utility will endear itself to anyone who is familiar with an operating system that maintains multiple file versions. These systems, usually running on mainframes or minicomputers, use a filename, extension, and version number in a form like RENVER.PAS;001. Alas, under DOS we must forfeit extensions for such files because there's nowhere else to keep the version number.

As originally written, RENVER renamed files by using the Exec function to invoke a secondary copy of COMMAND.COM. Since Turbo Pascal has its own Rename procedure, I eliminated the secondary command processor.

The easiest way to store a numbered version of a file *and* retain the file under its original name is this:

- Save the file by using the program that created it, with a standard filename like RENVER.WP.
- Shell to DOS and use RENVER to rename the file to a numbered version.
- Exit the DOS shell and save the file again under the original name.

Many word processing programs now have the ability to compare two documents and generate a third with redline and strikeover text showing deletions and insertions. Combine this ability with RENVER, and you have a simple way to track changes. □—*Neil J. Rubenking*

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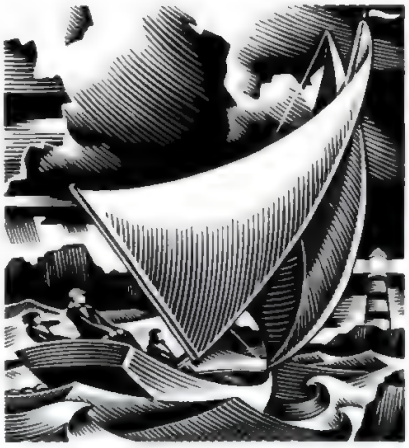

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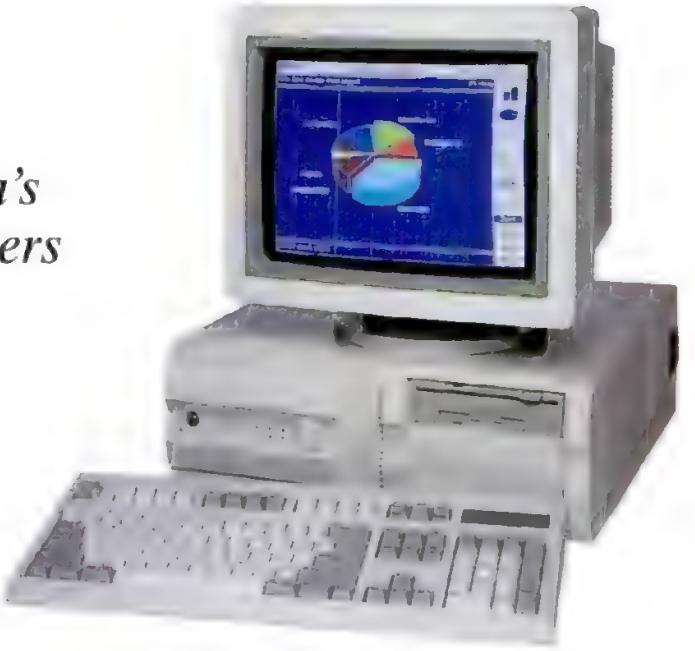

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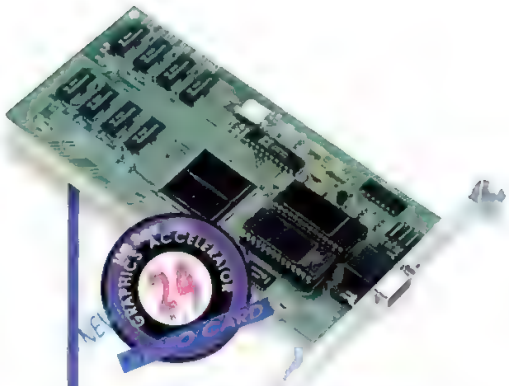

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ADVISOR

Learning Pascal: Books that get you started on programming in Pascal. **RAM Upgrades:** What you need to know when adding memory.

BY JOE SALEMI

Learning Pascal

Do you know of any books or tutorials that can help me learn to program in the Pascal language? I've recently installed Turbo Pascal Professional, Version 6.0, on my computer and plan to take a course at a local junior college sometime soon, but in the meantime, I'd like to get started on my own.

Marcel Richer
Bellingham, Massachusetts

▶**PC MAGAZINE** The best introduction I've seen to the Pascal language is *Oh! Pascal!*, Second Edition, by Doug Cooper and Michael Clancy (W.W. Norton & Co., 500 Fifth Ave., New York, NY 10110; ISBN 0-393-95445-5; $35.95). Although it was last updated in 1985, it presents an easy, step-by-step series of instructions and examples that teach the basics of Pascal and structured programming.

Once you've mastered the concepts and techniques introduced in *Oh! Pascal!*, you'll be ready to move on to *Turbo Pascal 6.0 Techniques and Utilities* by *PC Magazine*'s technical editor, Neil J. Rubenking (Ziff-Davis Press, 5903 Christie Ave., Emeryville, CA 94608; ISBN 1-56276-010-6; $39.95). This book covers the specifics of using Turbo Pascal 6.0, and it includes two 1.2MB floppy disks containing a variety of code samples and programs that can help you get the most from the compiler.

You should have no difficulty finding either book in most large bookstores or computer specialty stores. You can order Ziff-Davis Press books through ZiffNet by typing GO ZDBOOKS at the prompt, by fax from BookNet at 510-601-2099, or by mail from BookNet at the Ziff-Davis Press address listed above. To order by phone, call 800-688-0448 in the U.S. or 800-263-4374 in Canada.

You can also find a wealth of information and sample source code on CompuServe in Borland's programming forum. Just type GO CIS:BRPOGA at the prompt to get there.

RAM Upgrades

I'm planning to add more RAM to my 386DX system. I've checked around, and the computer's manual says it takes 256K or 1MB SIMM chips. However, when I check on available SIMMs, I'm always asked if I need 1MBx9 or 1MBx8 chips, and if I want 70-ns, 80-ns, or 100-ns chips. Does it matter which ones I get? If so, how can I tell which ones are the right ones for my system?

Shen Wang
Anaheim, California

▶**PC MAGAZINE** When memory vendors talk about "x8" or "x9" SIMMs (single in-line memory modules), they're referring to the number of actual memory chips on the board. An *8-by-1-megabit* SIMM contains eight chips of 1 megabit (Mb) each; since 8 bits make a byte, the module contains 1 full *megabyte* (MB). Systems that do parity checking use the ninth chip as the parity chip, for holding and comparing the checksums.

If your manual doesn't specify which type to get, the only way to tell for sure is to open the system and examine the SIMMs that are already on the motherboard. If the current ones have nine chips, you'll need the 9-by-1Mb SIMMs. You should never mix the two different types; doing so can cause memory problems and could even prevent your system from booting, as it will be unable to complete the power-on tests.

Chip speed is a different matter altogether. The "ns" refers to the chip's memory refresh rate in nanoseconds (the refresh rate is governed by the CPU and other control chips in the system). The lower the number, the faster the chips are. You can usually use SIMMs with a faster rating than those found in your system without experiencing any sort of problems. But you shouldn't install chips slower than those that are already there; doing so can cause timing problems and memory or parity errors that will usually lock up any applications you're running, forcing you to reboot the system. In addition, most system vendors advise against mixing chips of different speeds in the same memory bank. You should check your computer's manual or system board for a diagram that indicates which SIMMs are banked together, and keep the SIMMs in the same bank at the same speed. □

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FASTMICRO REVEALS THE SECRET BEHIND THE FASTEST 386 EVER!

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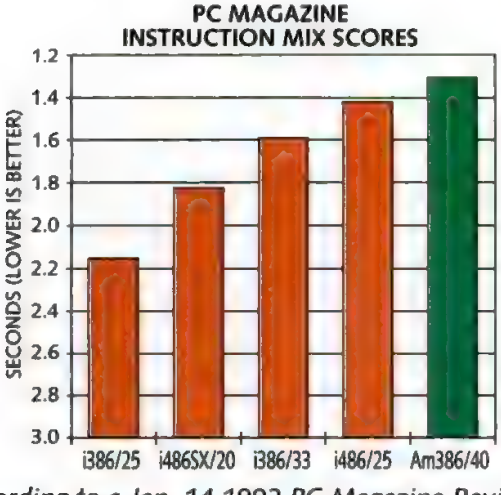

According to a Jan. 14 1992 PC Magazine Review, the Am386/40 was faster than all other 386 processors, it was even faster than most available 486 processors!

Look under the hood.

The AMD processor is easy to spot. Just look for the logo to the left. It's the only way to get the fastest 386 performance at the price of an ordinary 386 PC.

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Not only is the Am386DXL-40 faster than the i486-25, it's a better value too! The AMD chip costs a lot less than the price of the

Compare the cost of the Am386DXL-40 against the i486SX-25 and the faster Am386 chip actually costs less! FastMicro really stretches your computing budget.

486SX and FastMicro passes the savings and performance gain on to you. Plus, there is no sacrifice in upgradablility - read on!

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The Am386 processor family is certified compatible with all 386 compatible hardware and software. It has flawlessly passed tests from every top computer publication and has been tested in over 100 different 386 systems (including FastMicro's) and passed all tests without a single failure or incompatibility. Its compatibility has even been certified by XXCAL Testing Labs.

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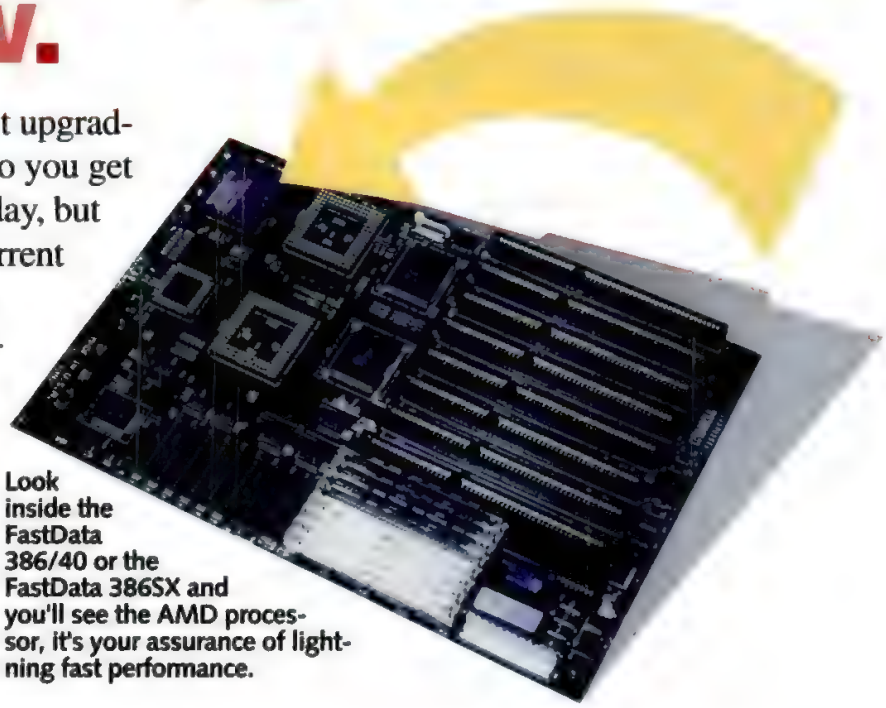
The FastData 386-40 is the most upgradable PC on the market! Not only do you get the most power for your money today, but you can upgrade your system to current and future 486 processors. Unlike competitors' very expensive proprietary upgrade cards, all you do is plug in a new processor & a $20 clock crystal (the silver part at the top center of the board) and change some jumper settings. Processors & crystals are widely available. You can install i486DX, i486DX/2, i486SX, announced AMD 486 CPUs & even promised next generation upgrade processors, all up to 50mhz external clock rate (100mhz for DX/2s and other doubler designs). That's more flexibility than other companies' 486 computers. FastMicro really maximizes value today and protects your investment tomorrow!



Look inside the FastData 386/40 or the FastData 386SX and you'll see the AMD processor, it's your assurance of lightning fast performance.

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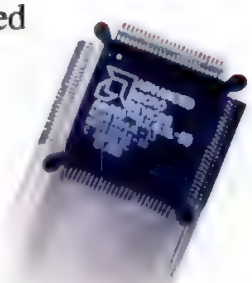

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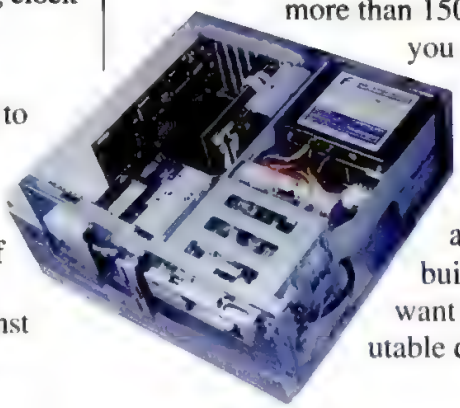

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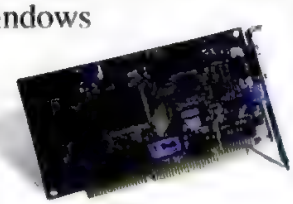

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This 14" SuperVGA non-interlaced monitor provides resolutions up to 1024x768. It works with virtually all VGA cards and has scan rates up to 90 hz. Its .28 mm dot pitch and 800x600 make this monitor easy on the eyes. It supports up to 16.7 million colors and has an auto-swithing power supply from 90-260 volts.

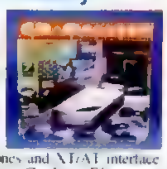
Lotus SmartSuite for Windows $449

SmartSuite includes full-featured Lotus applications including: 1-2-3 for Windows, Ami Pro for Windows, Freelance Graphics, and cc:Mail. These leading-edge applications in SmartSuite share more than just the Lotus name. They share innovations like SmartIcons for one-click access to the tasks you perform most. SmartSuite offers easy, consistent installation, menus, displays and help tools.

HARDWARE

CD & MULTIMEDIA

NEC CD Gallery $559



Get a whole CD set-up at one low price. Includes NEC CDR-37 Ext. CD player, a pair of amplified speakers, stereo headphones and XT/AT interface. Also includes Grolier Electronic Encyclopedia, Time Table of History, World Atlas, TIME Almanac, National Geographic Mammels, Great Cities of the World, and Battle Chess CD's

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- Baseball's Greatest Hit 49
- BattleChess or Carmen SanDeigo 45
- Berlitz Think & Talk French 99
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- Book of Mammals 49
- Encyclopedia 69
- MS Bookshelf, Stat. Pack, World Atlas & Consultant 99
- MS Multimedia Beethoven 55
- MS Multimedia Bookshelf 125
- PC SIG Shareware CD 99
- U.S. or World Atlas - MPC Vers. 85
- World Atlas or U.S. Atlas 45

Video Blaster $329

The ultimate in video versatility for multimedia computing. Integrate video from a wide range of sources - video cameras, VCRs, TV - with your PC applications. Runs within Windows and lets you combine video with text & graphics

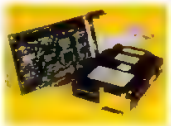
CD-ROM Hardware
- Hitachi Ext. 680mb Kit 449
- NEC Ext. CD Gallery w/CDR37 559
- Pinnacle Internal CD-Rom w/Atlas 319
- Pinnacle External CD-Rom w/Atlas ..379
- Soundblaster Pro w/ Int. CD Kit 559
- Sony Int. CD Drive Kit 349

ATI Stereo F/X 129

Creative Labs
- Multimedia Kit CD-ROM & SB Pro 559
- Sound Blaster 95
- Sound Blaster Pro (stereo & MIDI) ...179
- Video Blaster 319

DRIVES

Seagate 130mb IDE Kit $339



IDE performance, big 130 megabyte capacity, 19ms access time and 5 mbps transfer rate make this a great buy. Controller, cables and rails are included to make installation fast and easy.

Colorado
- DJ-10 40-120mb Int. Tape 199
- DJ-20 80-240mb Int. Tape 259
- External Kit w/AB11 99

DTC
- 6280 ESDI 16bit HD/FD Cont 119
- 6280-15T 24mbit/sec transfer rate 169

Maxtor
- 7120A 120mb 15ms IDE 299
- 7213A 213mb 15ms IDE 499

Micropolis (see DTC Controllers)
- MC1664 345mb HH ESDI 14ms 899
- MC1568 668mb FH ESDI 14ms 1399
- MC1518 1.3gb FH ESDI 14ms 2399

Plus Development
- HardCard IIXL 50mb 9 ms 16bit 249
- HardCard IIXL 105mb 9 ms 16bit 399

Quantum
- LPS52A 52mb 9ms IDE 199
- LPS120A 120mb 9ms IDE 339
- LPS240A 240mb 9ms IDE 599

Teac 1.44mb 3.5" or 1.2mb 5.25" Floppy Drive $59

Genuine Teac quality at a low FastMicro price, these high density floppy drives also read, write & format low density floppy disks. They work great with all true 286, 386 & 486 compatibles. 1.44 mb 3.5" drive includes mounting kit and bracket. For rails for 1.2mb 5.25" drive, add $5.

DRIVES CONT.

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- 105MB ST3120A 19ms IDE Drive ...279
- 125MB ST3144A 19ms IDE Drive ...299
- 245MB ST3283A 12ms IDE Drive ...549
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- 1.3MB ST41600N 14ms SCSI 2299

Teac
- 1.2MB 5.25" Floppy 59
- 1.44MB 3.5" Floppy 59

Toshiba
- 360K 5.25" Floppy (Black) 59
- 1.2MB 5.25" Floppy 59
- 1.44MB 3.5" Floppy 59

Western Digital
- WDAC280 80mb IDE 20ms 259
- WDAC2120 120mb IDE 20ms 299
- WDAP4200 200mb IDE 20ms 479

MODEMS

ATI
- 2400 ETC V.42 Int. / Ext. 75/99
- 9600/E External MNP V.42bis 279

Everex 2400B Int Modem 65

Hayes
- Optima 9600 Ext. 349
- Optima 9600 Ext.w/ Fax 379
- Ultra 144 Ext. 669
- Pocket Edition 2400 Modem 119

Optima 9600 $349

Hayes quality and affordability in this V.32 9600 bps modem. V.42bis boosts throughput to 38,400 bps. It also includes V.42 & MNP 5 error correction and automatic feature negotiation for the most efficient performance.

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- Classic 2400 Modem Int./ Ext ...139/149
- Satisfaxtion Int. 100/ 200 ....99 /299

Practical Peripherals
- 2400B Int Modem Std/MNP ....79 /119
- PM9600SA Int. / Ext. ....279 /299
- PM14400FX Int. / Ext. ....379 /419

US/Robotics
- 2400 Sportster MNP Int / Ext. ....149 /159
- 9600 Sportster Int / Ext. ....399 /449
- Courier HST 14,400 Int. / Ext. ....539 /559
- Courier HST 14,400 Dual Std Ext. 799

ZOOM
- 2400b Internal Modem 59
- 2400 V.42bis External Modem 119
- 9624 Send/Receive Int Fax Modem. ..79

MICE & INPUT

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Whether you're a graphics or CAD user, the XLP is easy to use. Drivers include AutoDesk ADI and Windows 3.1 support. Bundle includes 4-button cursor, pen and lifetime warrantee. XLP-1218 available for $529

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- Mouseman Bus righthand 65
- Mouseman Cordless 85
- PhotoMan 499
- ScanMan 32 139
- ScanMan 32 with Catchword 179
- ScanMan 256 for Windows 259
- Trackman 9/25 75

Microsoft
- Serial or Bus Mouse only 83
- Serial or Bus with paint 95
- Serial with Windows 147

NETWORKING

Artisoft/Lantastic
- Lantastic for Windows 165
- Lantastic 2 Station Ethernet Kit 468
- Ethernet Additional Stations 208

Eagle
- NE2000 2 Station NW Lite Kit 459
- NE1500 16 Bit 10baseT Adapter 149

FastData NE2000 16 Bit 10-BaseT 109

Intel EtherExpress 16 or 16TP 129

Novell Netware Lite 1.1 w/ DR DOS 65

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- Graphics Vantage 1mb 219
- VGA Basic 16 / Integra ....65 /79
- VGA Wonder XL24 1mb 149
- Graphics Ultra 8514+VGA 1mb 479

Diamond
- SpeedStar24X 16 Million Colors 179
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- Diamond Scan 16L 919

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- Multisync 5FG 1399

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- Farenheit 1280s HiColor 319

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Sony 1304 Multiscan 599

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- FasMath387SX 75

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- RAM3000 16 bit - w/ 0K (max 3mb) 75
- RAM3000 16 bit - w/ 1mb 125
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- RAM8000 16 bit - w/ 2mb 269

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- 387-DX 85
- 387-SX 79
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Memory - 1mb chips 80ns set of 9 39

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- BJ300 / BJ330 Ink Jet ....459 / 599
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Epson ....Call

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- P3300 24 Pin Wide 339
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- Silentwriter 2 Model 95 1444

Traveller 9624FP $109

Ideal for portable and notebook computers, the Traveller Pocket FaxModem includes 9600/4800 bps send/receive fax and 2400bps modem with V.42 bis & MNP 2-5 for 9600bps throughput. It's runs on a nine-volt battery or supplied AC adapter and includes software and modem cable too! It's built in the U.S. and has a 2 year warranty.

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Panasonic 4410 Laser $649

The Panasonic KX-P4410 includes 5 PPM, HP IIP emulation, a large 200 sheet paper tray and 28 standard fonts. It works with all current major software programs, has 512K of upgradable memory, and has an EZ-set LCD panel.

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- Okilaser 400 599

Panasonic
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- KXP1123 24 Pin 199
- KXP1124i High Speed 24 Pin 279
- KXP1624 24 Pin Wide 339
- KXP2180 Quiet 9 Pin 179
- KXP2123 Quiet 24 Pin 259
- KXP2124 Quiet 24 Pin ....Call
- KXP21XX Series Color upgrade kit 59
- KXP2624 High Speed Quiet 24 Pin ..399
- KXP4410/4430 Laser 649/Call
- KXP4450i Laser 1069
- KXP4455 Laser 1699

QMS PS410 1599

Seiko Smart Label Printer Plus 139

Panasonic 24 Pin KX-P2123 $259

The Panasonic KX-P2123 combines high-quality 24 pin printing with 10 resident fonts and color upgradability at a great FastMicro price! It includes an easy to set front panel and prints up to 240 cps in draft mode. It is very quiet with only 46.5 dBA in standard mode and 43.5 dBA in Super Quiet mode. Plus, it has a two year warranty and you can upgrade to color for just $59.

Star
- NX1001 139
- NX2410 / 2415 ....189 / 369

Texas Instruments
- Microlaser Plus PS17 1199
- Microlaser Plus PS35 1299
- Microlaser PS35 Turbo 1599

FASTDATA PRODUCTS

FastData Boards
- 16bit 1mb VGA 69
- 16bit 256K VGA 45
- 2400B Internal Modem 49
- 9600B Send/Rec. Fax w/2400B 69

1mb SVGA Card $69

Resolution up to 1024x768 & 256 Colors, 16 bit interface and Trident VGA chip make the FastData 1mb SVGA card a great buy. Its compatible with all standard compatibles & VGA/SVGA monitors.

- CGA Card 35
- Ethernet 16bit 10Base-T 109
- IDE 16 Bit Hard/Floppy Disk Cont. 29
- IDE HD/FD w/Par/2 Serial/Game 39
- MGP Card 29
- Parallel/2 Serial/Game Card 29
- RLL 16bit 1:1 Hard/Floppy Disk Cont..59
- XT 1.44 Dual Floppy Controller 35

FastData Monitors
- 14" Amber or White TTL Mono. 99

FastData 2496 SR FaxModem $69

A great value, the FastData 2400 baud internal modem with 9600 send and receive fax works with all industry standard PC's and includes BitFax software, and is configurable from COM 1 - COM 4. Its made in the U.S. and uses a Sierra chipset for reliability.

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- 14" Non-Int VGA 1024x768 .28 dp. 329

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= Windows Software

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- Clanon Professional Developer 3.0 449
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- DataEase 509
- dBase III+ 419
- dBase IV 1.5 479
- w DBfast for Windows 319
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- FoxPro 449
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- Paradox Competitive Upgrade 165
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- Bannermania 21
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- w Pagemaker 489
- w PFS Publisher 89
- Printshop 33
- Publisher's Paintbrush 279
- Publish It! 89
- w Ventura Publisher for Windows 499
- w Ventura Database Publisher 179

Smartcom Exec $69

Powerful communications software that combines terminal emulations, error-control protocols, and a text editor to meet the needs of virtually any user. In addition to modem sharing support over a LAN, Smartcom Exec provides SCOPE scripting language, keyboard macros, mouse control and more. It provides options for installation in one or more languages (English, French, Italian, Spanish or German) and multi language documentation. SmartCom Exec also supports popular terminals emulations and error-control file transfer protocols.

ENTERTAINMENT

- AutoMap U.S.A./Europe ..... 45 /75
- BodyWorks /Orbits ..... 39 /29
- Carmen SanDiego Deluxe Edition 45
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- Falcon 3.0 45
- King's Quest 5 (VGA Vers.) 38
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- w Microsoft Ent. Pack I, II or III 27
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  - Aircraft & Scenery Designer 27
- w Microsoft Golf 47
- PC Globe or PC USA 35
- Simcity or Simcity for Windows 28
- SimEarth 39
- Wing Commander I / II ..... 39 / 45

FINANCIAL

Peachtree for Windows $69

Peachtree Accounting comes to Windows! It combines the easy to use graphical interface of Windows with powerful accounting features. This fully integrated system includes Gen. Ledger, Accts. Rec., Invoicing, Accts. Payable, Payroll, Inv and Job Costing. Writing checks is on-screen easy and bank reconciliation is practically automatic. Plus its custom forms, report writer & data exchange really flex to your needs.

- ACCPAC BPI Value Pak 359
- ACCPAC Simply Accounting DOS 119
- w ACCPAC Simply Acctg Windows 119
- DAC Accounting 4.2 85
- DAC Bonus Pack 4.2 119
- DAC Accounting Upgrade 45
- Managing Your Money 47
- w Microsoft Money for Windows 45
- Money Matters 29
- w M Y O B 129
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- Harvard Graphics DOS ..... Call
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- MS C/C++ 7.0 w/ Win SDK 299
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- MS Quick Basic 60
- MS Quick C DOS 60
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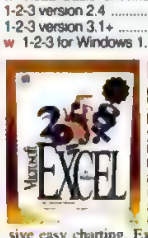
- w Turbo Pascal for Windows 119
- w Visual Basic for Windows 125
- 1-2-3 version 2.4 325
- 1-2-3 version 3.1+ 399
- w 1-2-3 for Windows 1.1 339



Excel 4.0 $325

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The #1 Word Processor comes to Windows! WordPerfect 5.1 for Windows is simple, powerful, and fun to use. WPWin includes customizable ButtonBar™, Dynamic Data Exchange, and full graphical integration. Upgrade from WP for DOS for $79

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- w WordPerfect for Windows 249
- Microsoft Word for DOS 209
- w Microsoft Word for Windows 299
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- Multimate 4.0 239
- PC Write Standard Level 59
- Professional Write 159
- Publisher's PowerPak / WordPerfect 45
- Rightwriter DOS 55
- w RightWriter for Windows 55
- WordPerfect 5.1 249
- w WordPerfect for Windows 249
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- WordPerfect Add'l Station License 159
- WordPerfect Office 89
- w WordStar for Windows 89
- WordStar Pro 259
- Writer's Toolkit DOS/Windows 79/79

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- Direct Access 57
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- PC Tools Deluxe 7.1 105
- Personal Lawyer 15

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- P.D. Queue 55
- Pop Drop Plus 53
- PrintRite 19
- ProComm Plus 65
- Prodigy 25
- QA Plus 85
- QEMM 386 6.0 57
- QRAM 2.0 49
- SideKick 2.0 59
- Sideways 35
- Smartcom Exec 69
- SprintRite II 69
- Stacker 79
- Stacker XT8 / AT16 ..... 149 /179
- Super PC Kwik 49
- Virex-PC 75
- XTree Gold 2.5 89

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- w Adobe Type Align 59
- w Adobe Type Manager 59
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- w After Dark for Windows 25
- w BeckerTools 37
- w Bitstream MakeUp 89
- w CA-Up To Date 89
- w CA-SuperProject for Windows 539
- w Direct Access Windows 60
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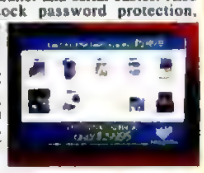

dBFast $329

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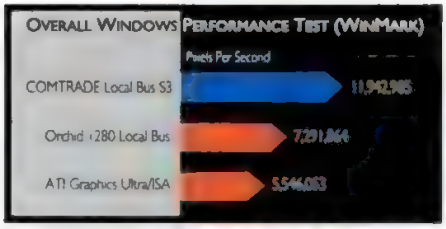

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TUTOR

Saving Program Manager Settings: How to prevent users from altering Program Manager settings.

BY JEFF PROSISE

Saving Program Manager Settings

Our university has Windows 3.1 installed on several of the PCs in our computer labs, and we use the Program Manager as the primary Windows shell. One of the problems we're experiencing is that students often alter the default Program Manager settings while they work on the PCs and then save the settings when they exit. When the next student sits down at the machine, he or she may be faced with an unfamiliar environment. For those who are new to Windows, the prospect of getting back to a known starting point can be daunting. Is there a mechanism for preserving Program Manager settings so that they're the same for all users? Better yet, is it possible to restrict Program Manager operation so that settings can't be saved on exit, and so that users are unable to add new icons to a program group or edit existing ones?

John Smith
New York, New York

▶**PC MAGAZINE** You can accomplish all this and more by adding a few lines to the PROGMAN.INI file in each PC's Windows directory. First, make a backup copy of PROGMAN.INI, just in case something goes wrong. Then call up the original in Windows Notepad or your favorite text editor and add these three lines to the end of the file:

```
[restrictions]
NoSaveSettings=1
EditLevel=4
```

Save your changes. Now restart Windows and pull down the Program Manager's File menu. All menu items except Open, Properties, Run, and Exit Windows should be disabled. The Save Settings Exit menu item in the Options menu should also be disabled. Configured this way, Windows will not allow users to save changes made to the Program Manager. Nor will it let users add, delete, or edit program groups; add or delete program items; or change program item information in any way. In short, the user's freedom to change the setup of the Program Manager is severely restricted.

As the name implies, this [restrictions] section of PROGMAN.INI specifies a set of constraints that the Program Manager will enforce at the user level. Figure 1 lists the entries you can add to this section, and their meanings. The NoRun=1 statement disables the File menu's Run command, but it is only marginally useful for preventing programs not represented by icons in the Program Manager from being run, because there are plenty of other ways to launch programs in Windows.

NoClose=1 prevents users from terminating the Program Manager and, if the Program Manager is the primary shell (as specified with a SHELL= statement in the [boot] section of SYSTEM.INI), from exiting Windows. Be careful with this option. Unless you have another utility that initiates a Windows shutdown, there's no way out except to reboot.

NoSaveSettings=1 disables the Program Manager's Save Settings on Exit option, while NoFileMenu=1 removes the File menu altogether. Finally, the EditLevel statement supports four different and increasingly curtailed levels of restriction. □

The [restrictions] Section of PROGMAN.INI

Entry	Result
NoRun=1	Disables the Run command in Program Manager's File menu.
NoClose=1	Disables the Exit Windows command in the File menu, the Close command in the control menu, and prevents the user from exiting Windows using the Alt-F4 key combination.
NoSaveSettings=1	Disables the Save Settings on Exit command in the Options menu.
NoFileMenu=1	Suppresses the display of Program Manager's File menu.
EditLevel=1	Disables the New, Move, Copy, and Delete commands in the File menu and prevents the user from creating or deleting program groups. Also disallows editing of any of the information in the Program Group Properties dialog box.
EditLevel=2	Same as EditLevel=1, but also prevents users from creating or deleting program items.
EditLevel=3	Same as EditLevel=2, but also prevents users from editing the Command Line field in the Program Item Properties dialog box.
EditLevel=4	Same as EditLevel=3, but also prevents users from editing any of the information in the Program Item Properties dialog box.

Figure 1: **Adding these commands to PROGMAN.INI can restrict users' abilities to alter the Windows environment.**

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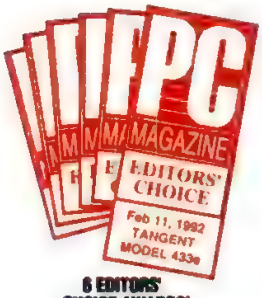

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CIRCLE 215 ON READER SERVICE CARD

USER-TO-USER

Screen Saver Security: Two ways to invoke a Windows 3.1 screen saver on demand.

BY NEIL J. RUBENKING

Screen Saver Security

The Windows 3.1 screen savers can be set to require passwords before they stop displaying, thus preventing unauthorized people from seeing what you're working on or making any changes to your system. The problem with this security feature is that it's active only when the screen saver is active. Most users set the screen saver to activate after 10 or 15 minutes of idle time—any less and the display may blank before you can read the screen or think about what you're working on. Between the time you leave your desk and the time the screen saver kicks in, your Windows environment is not secure.

Fortunately, it's reasonably easy to force the screen saver (and its password protection) to start immediately. All screen savers that use the Windows 3.1 screen saver functions are stored as .SCR files in your Windows directory. If you copy any of these to an .EXE file, you can run it like any other Windows program. Just run the screen saver with a /S switch on the command line and it will blank the screen immediately. Omit the /S switch and you get the screen saver's setup dialog box.

If you decide to use this technique regularly, you'll want to add the .EXE file as a program item in your favorite program group; the screen savers include appropriate icons. Note, however, that the password and other settings apply only to the screen saver currently selected by the Control Panel. Once you've set up an .EXE file screen saver, keep the corresponding .SCR screen saver selected in the Control Panel.

Windows 3.1 comes with five screen savers. Here are their filenames and corresponding Control Panel descriptive names:

- SCRNSAVE.SCR—Blank screen
- SSFLYWIN.SCR—Flying Windows
- SSMARQUE.SCR—Marquee
- SSMYST.SCR—Mystify
- SSSTARS.SCR—Starfield Simulation

Note that not all screen savers use the Windows 3.1 screen saver facility. This technique applies only to screen savers you can select via the Control Panel.

Paul Thomsen
Missauga, Ontario, Canada

SAVENOW.PAS

Complete Listing

```
{$R-,S-,L-,D-}
PROGRAM SaveNow;
{$R SAVENOW}
USES WinTypes, WinProcs, Strings;
VAR SSName : ARRAY[0..150] OF Char;
BEGIN
  IF GetProfileInt('Windows', 'ScreenSaveActive', 0) = 0 THEN
    MessageBox(0, 'Use Control Panel to select a screen saver',
      'ERROR', mb_Ok + mb_IconStop)
  ELSE
    BEGIN
      GetPrivateProfileString('boot', 'SCRNSAVE.EXE', '', '
        SSName, 150, 'SYSTEM.INI');
      IF SSName[0]=#0 THEN
        MessageBox(0, 'Use Control Panel to select a screen saver',
          'ERROR', mb_Ok + mb_IconStop)
      ELSE
        BEGIN
          StrCat(SSName, ' /S');
          WinExec(SSName, sw_Normal);
        END;
    END;
END.
```

Figure 1: **This little TPW program instantly activates the selected Windows 3.1 screen saver.**

▶PC MAGAZINE It's good to know you can simply run a screen saver, as long as you copy it to an .EXE file first. If you have a favorite screen saver, the technique described above is a great way to make it available for screen saving on demand.

But some of us just can't leave the Windows environment alone. I'm always changing my system colors, wallpaper, and screen saver. Rather than copying every .SCR file to an .EXE file and then trying to remember which is currently selected, I devised a tiny program in Turbo Pascal for Windows. The SAVENOW program shown in Figure 1 first checks WIN.INI to be sure screen saving is enabled, and then gets the filename of the current screen saver from SYSTEM.INI. If screen saving is not enabled, or if it fails to get the screen saver name, SAVE NOW displays a message instructing the user to select a screen saver in the Control Panel. Otherwise, it tacks a /S switch onto the program name and executes the .SCR file directly.

You don't have to worry about the inner workings of SAVENOW.EXE in order to use it. Just download the file from PC MagNet (as SAVENO.ZIP); it's less than 3K. Install the program in an appropriate program group and you're ready to activate the current screen saver. □

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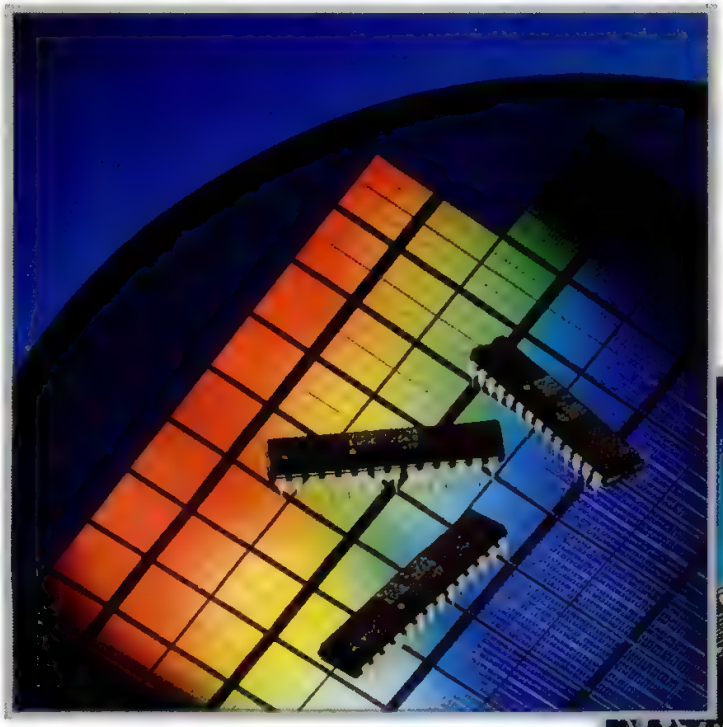

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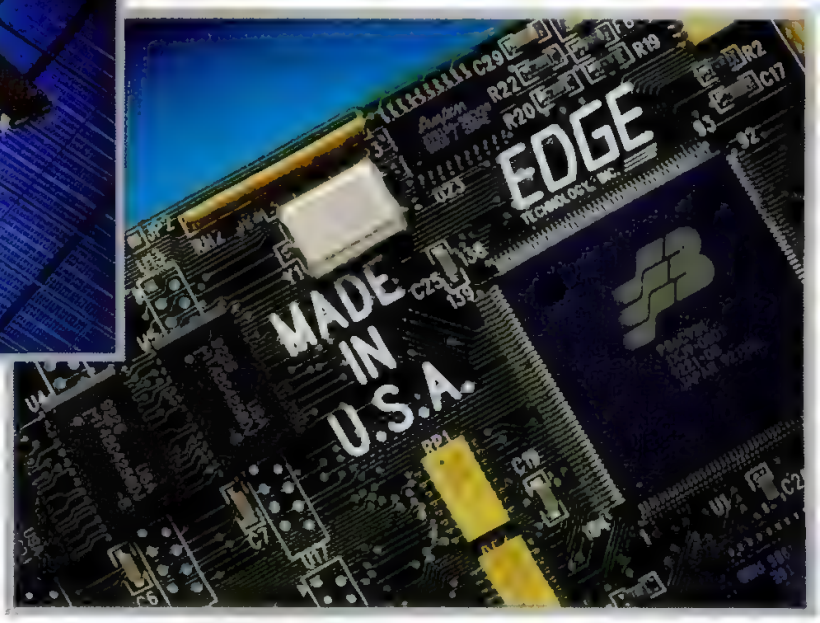

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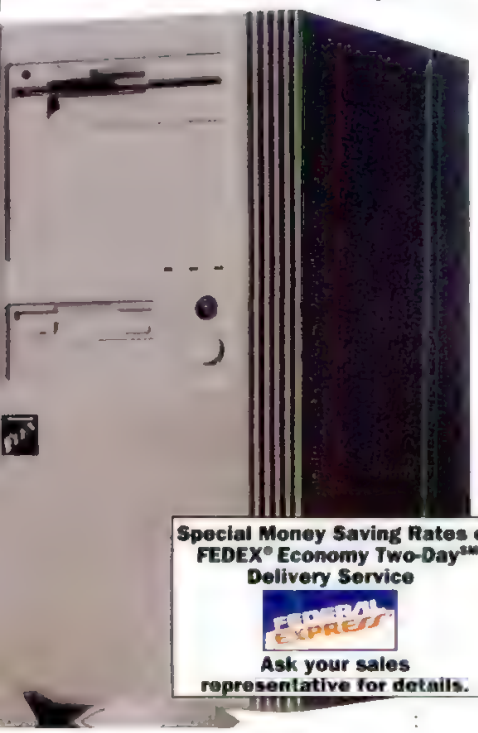

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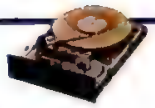

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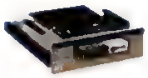

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Windows Magazine, May 1992

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PC Sources, May 1992

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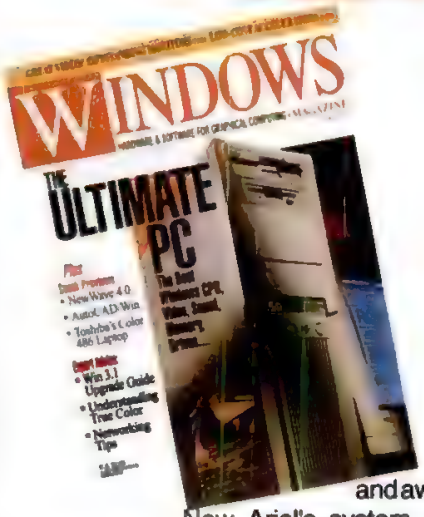
And Run.

ARIEL'S VESA STANDARD LOCAL BUS



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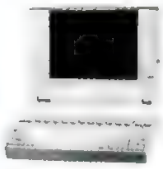

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SPREADSHEETS

Crosstab Tables in Excel: Version 4.0 has a better way. **The Bottom Line:** Why you should put your spreadsheet totals at the top.

BY CRAIG STINSON

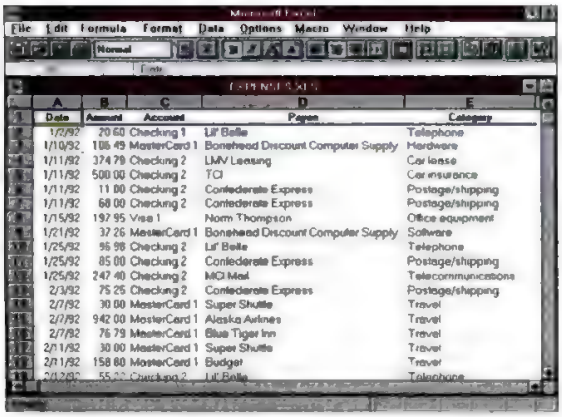
Crosstab Tables in Excel

Excel's documentation presents the Data Consolidate command as a way of combining data from several spreadsheets. However, it is also a very powerful tool for summarizing data from a single worksheet. This use of Data Consolidate gets only the briefest mention in the documentation, but it was pointed out to me by the Excel tech support people, and it has saved me a great deal of time.

Robert Saxe
La Canada, California

▶**PC MAGAZINE** Mr. Saxe is right. You can use the Consolidate command in either Microsoft Excel 3.0 or 4.0 to pull together information from various places on a single worksheet—as well as for its more customary "roll-up" purposes. You can also use it as a simple cross-tabulator to summarize numerical information stored in a single data block.

For example, suppose you have the transaction database shown in Figure 1. With a little effort on your part, the Consolidate command can turn this into the summary table shown in Figure 2. Each figure in the second column of the table shows the total of the Amount field for each record with the associated Category value. In other words, the table tells you how much you've spent in each expense category.



Date	Amount	Account	Payee	Category
1/2/92	20 60	Checking 1	Lil' Belle	Telephone
1/10/92	106 49	MasterCard 1	Bonehead Discount Computer Supply	Hardware
1/11/92	374 79	Checking 2	LMV Leasing	Car lease
1/11/92	500 00	Checking 2	TCI	Car insurance
1/11/92	11 00	Checking 2	Confederate Express	Postage/shipping
1/11/92	68 00	Checking 2	Confederate Express	Postage/shipping
1/15/92	197 95	Visa 1	Norm Thompson	Office equipment
1/21/92	37 26	MasterCard 1	Bonehead Discount Computer Supply	Software
1/25/92	96 98	Checking 2	Lil' Belle	Telephone
1/25/92	85 00	Checking 2	Confederate Express	Postage/shipping
1/25/92	247 40	Checking 2	MCI Mail	Telecommunications
2/3/92	75 25	Checking 2	Confederate Express	Postage/shipping
2/7/92	30 00	MasterCard 1	Super Shuttle	Travel
2/7/92	942 00	MasterCard 1	Alaska Airlines	Travel
2/7/92	76 79	MasterCard 1	Blue Tiger Inn	Travel
2/11/92	30 00	MasterCard 1	Super Shuttle	Travel
2/11/92	158 60	MasterCard 1	Budget	Travel
2/12/92	55 [illegible]	Checking 2	Lil' Belle	Telephone

Figure 1: **This database of expense transactions is summarized in the crosstab table in Figure 2.**

For this to work, the column whose values you want to aggregate must be the first one in the database. So if your data is organized as in Figure 1, you have to rearrange your fields to get the table shown in Figure 2. That's a pain in the neck, but remember, the Consolidate command wasn't really designed for this sort of thing! (As we'll see in a moment, Excel 4.0 offers a simpler alternative.)

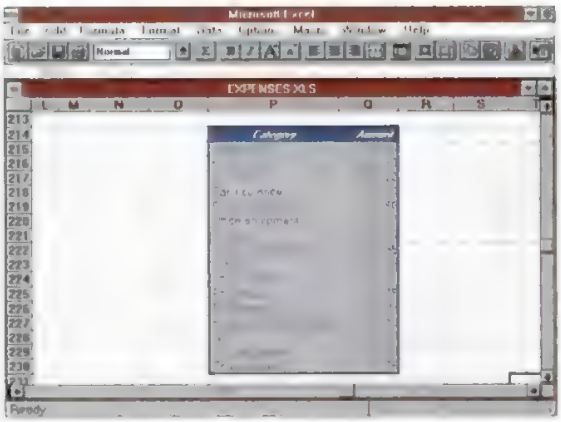


Figure 2: **After reordering and applying the Data Consolidate command, you can get this summary of the data in Figure 1.**

Once you have the summary field in the leftmost column, copy the field headings you're interested in to a blank area of the worksheet. In Figure 2, we wanted the Amount totals by Category, so we copied the Category and Amount headings. Next, select those headings, pull down the Data menu, and choose Consolidate. In the dialog box, leave SUM as your aggregating function (unless you want some other information, such as the average amount for purchases in each expense category). On the Reference line, type the name or coordinates of your data range (you can simply type Database if you're working with a defined Excel database range). Click on the Add button, select the Top Row and Left Column check boxes, and click on OK.

As a cross-tabulator, the Consolidate command has several drawbacks. First, it's a miserable item to figure out, particularly if you use it only occasionally. The documentation is terse, the setup requirements are quirky, and the information content of the inevitable error messages is low, to put it kindly. Second, the output is static. If you use Consolidate to roll up data from two or more separate worksheets, you can generate linking formulas that are automatically updated as your source values change. For some reason, though, Consolidate can't create links within a single worksheet. To get an update, you have to repeat the command. Finally, Consolidate can't do a thing with nonnumeric values, not even count them.

If static output doesn't deter you, however, you may find tabulating with Consolidate less troublesome than creating a range of array formulas (for more information, see "Arrays in Excel" in the October 29, 1991, Spreadsheets column).

Excel users who upgrade to Version 4.0 have a much better option, though, in the form of the Crosstab Report-

Wizard. The Wizard is a strong and flexible report-generating tool. From our transaction database, for example, the Wizard could generate not only a simple tabulation of totals by category, but also a variety of other useful formulations—account subtotals within expense categories, subtotals for months or quarters, and category totals as percentages of the entire expense outlay. The Wizard's output is automatically outlined and linked to the source data (the table can be recalculated on demand so it can stay current with changing inputs). Best of all, you don't need an advanced degree to figure out how to use it. The Wizard holds your hand by showing you a diagram of your table while you're in the process of defining it, and by explaining your options in reasonably comprehensible English. It could be the best reason to consider upgrading to Version 4.0.

The Bottom Line

Sometimes it's hard to recognize that old pen-and-pencil habits are inappropriate for a computerized context.

Consider the traditional location of the totals formula: at the bottom of a column of numbers. In the days of manual addition, this position made sense because it forced us to keep our writing hand from covering the numbers that we were adding. But for computer spreadsheet use, I find it preferable to put totals at the top, directly below each column's label.

Putting totals at the top enables me to keep the total value in view at all times. I just use Lotus 1-2-3's /Worksheet Titles Horizontal command to lock the top rows of the sheet. Then, no matter how deep my columns go, I can still see the totals. Putting the totals at the top also makes it easy to include them on each page of a printout. I just designate the top rows of the worksheet as "row borders."

Howard I. Podell
New Rochelle, New York

▶**PC MAGAZINE** Mr. Podell's strategy makes sense, particularly if you use underscores or borders to separate the totals from the values being added. In general, it's not a bad idea to organize your worksheets with summary material at the top and subsidiary information below. That way, anyone looking at your work can get the message with a minimum of scrolling.

In Excel and Quattro Pro for Windows, another way to put the bottom line at the top is to open a second window on a worksheet. Then you can use sizing and positioning procedures to put summary rows near the top of your screen. If you do this in Quattro Pro for Windows, you'll probably want to remove the page tabs from the summary window so that they don't obscure the supporting information below. □

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THE WORKING WORD

Duplicating a Format: A quick way to apply a format to another section of text. **Rotating Graphics:** Printing landscape graphics on a portrait page in WinWord 2.0.

BY M. DAVID STONE

Duplicating a Format

There is a quick way to apply the formatting of existing text in Word for Windows to other text in a document. Highlight the text you want to format. Move the mouse cursor to the text that's already formatted the way you want, then hold down the Ctrl and Shift keys, and click the left mouse button. The formatting of the text you click on will be applied to the highlighted text. This technique works for changes in font, point size, bold, italics, underline, superscript or subscript, condensed or expanded, and any other changes you can specify through the Format Character dialog box.

Phillip P. Guttilla
Phoenix, Arizona

▶**PC MAGAZINE** This formatting shortcut is available in both WinWord 1.*x* and 2.*x*, and is fully documented in the Word for Windows manuals and in its on-line help. It's worth mentioning here because the procedure is arcane enough that you could easily miss it.

You can use a similar technique to duplicate paragraph formats, such as indents, spacing before and after, and so on. First, either place the text cursor in the paragraph you want to copy the format to or highlight all or part of the paragraph or paragraphs you want to copy the format to. Then move the mouse cursor to the hidden selection bar at the left of the paragraph with the formatting you want to copy. (The hidden selection bar is an invisible area located to the left of the text. You know you're in it when the mouse pointer suddenly changes to a right-pointing arrow.) Again, hold the Ctrl and Shift keys down and click the left mouse button to copy the paragraph format to the designated paragraphs.

Those who prefer using keyboard commands will want to look at CopyFormat, which can be found listed as a command in the appropriate dialog boxes in WinWord 2.*x* and as a macro in the equivalent dialog boxes in WinWord 1.*x*. (If you want to attach CopyFormat to a keyboard shortcut in WinWord 2.0, for example, choose Tools, Options, Keyboard, and pick Show Commands to see the CopyFormat choice. In WinWord 1.1, choose Macro Assign to Key to see the choice.)

You can easily rotate an imported graphic in WinWord by using Microsoft Draw.

Rotating Graphics

I often print graphics in Word for Windows 2.0a using graphics created in other programs. However, there doesn't seem to be any easy way to rotate the graphic so that it prints in landscape orientation while still having the headers and footers print in portrait orientation to match the rest of the document. I've worked around this problem by printing pages with graphics twice, printing the header and footer on an otherwise blank page, and then sending the page through the printer a second time for the graphic. Is there another choice for mixing orientations on the same page?

James Swartz
Chicago, Illinois

▶**PC MAGAZINE** There certainly is. You can easily do this by taking advantage of the Microsoft Draw mini-application that ships with WinWord 2.*x*. Simply leave the page in portrait format, which will put the headers and footers where you want them. Then, after importing the graphic (with the Insert Picture command or by pasting from the Clipboard), either double-click on it or select it with the mouse or keyboard and choose the Edit Picture command. This will convert the picture to a Draw object and take you to Draw with the object loaded so that you can edit it as you wish.

Once in Draw, choose Draw, then Rotate/Flip, followed by Rotate Left (or Rotate Right, as appropriate) to rotate the picture to the orientation you need. Note that you may have to move the object away from the edge of the Draw work area first. If you try rotating the graphic while it is too close to the edge, you will get an error message stating that you cannot rotate the object because it would extend off the edge.

Finally, be sure to update the document by choosing File, Update. Then exit Draw and get back to WinWord. □

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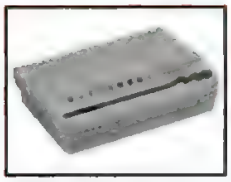

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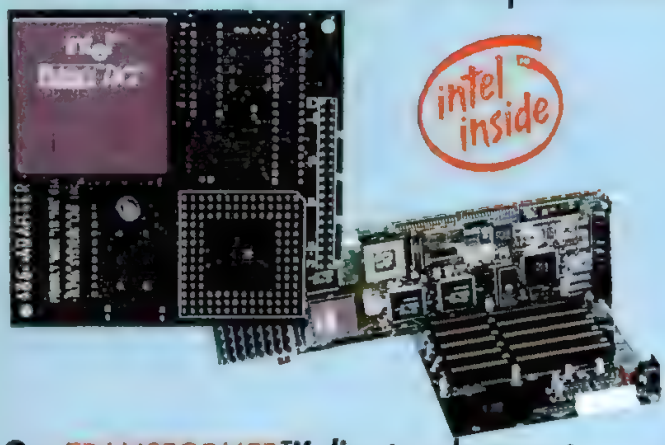

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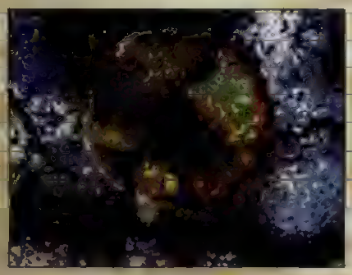
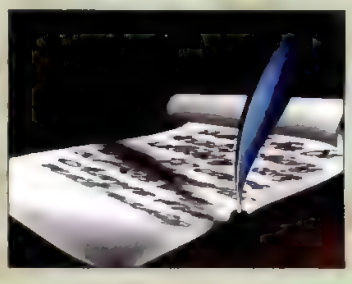


In the 15th Century design tools were quill ink pens and crude styles of paper.



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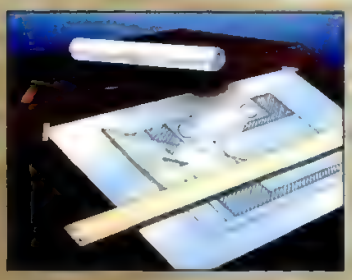

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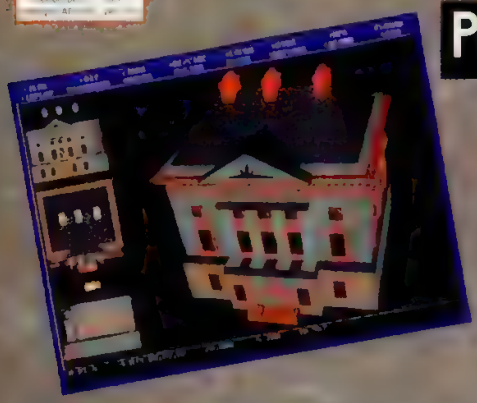

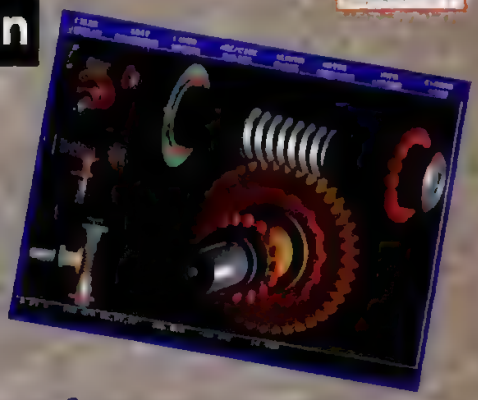

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CONNECTIVITY

Making Good Connections: Indispensable tools for Ethernet cabling problems.

BY FRANK J. DERFLER, JR.

Making Good Connections

We have frequent problems with our thin Ethernet wiring system, primarily from bad connections. Users sometimes get NetWare's "Server Not Found" message, and often performance is just unbearably slow. Do you have any hints for making good Ethernet connections?

Jubal King
Chicago, Illinois

▶**PC MAGAZINE** Thin Ethernet connections are particularly troublesome since, in the typical station-to-station wiring scheme, one bad connection disrupts the entire network. You need two indispensable tools: the best crimper you can find and an inexpensive volt-ohm meter.

If your installation uses twist-on BNC connectors, replace them with the crimp-on kind. Twist-on hardware cannot stand up to the constant reconnection caused by the here-today-gone-tomorrow life of a corporate PC. You should use high-quality crimp-on BNC connectors, a heavy-duty crimping tool with wide jaws and ratcheting handles, and T-connectors that will withstand a lot of strain. I like the Ethernet installation kit sold by Inmac (800-547-5444). The tools are sturdy and the case has a place for everything, so you lose fewer of the tiny gold connector center posts. Plan on spending about $70 for the crimping tool alone or $159 for a kit. If you do a lot of this work, the $49.95 coaxial cable stripping tool is valuable.

For Ethernet cable, one of the most practical and cost-effective troubleshooting tools you can own is Radio Shack's tiny $24.95 volt-ohm meter (catalog number 22-171). If you don't need a digital readout, the $12.95 model 22-212 will work fine.

Either meter will help you find open and shorted connections if you take advantage of the Ethernet terminators at both ends of the cable. Terminators use a resistor encased in a metal shell to absorb Ethernet signals, thus preventing them from reflecting back along the wire. They can also serve as a calibrated resistance, typically 50 ohms ±10%, for use in troubleshooting.

The resistors at each end connect the center conductor and the shield, putting them in parallel with each other and making the effective resistance half the value of a single resistor. Measure the resistance between the center conductor and outside shell of any connector in the network: With all PCs turned off or disconnected, it should be about 25 ohms. The cable adds 2 to 3 ohms per 100 feet, so add that to your measurements.

Twist-on hardware cannot stand up to the constant reconnection caused by the here-today-gone-tomorrow life of a corporate PC.

If the cable is open in one direction from your meter, you'll see only the series resistance of the terminator in the other direction—50 ohms. To isolate the problem quickly, remove either terminator. If the reading changes, the cable is good on that side of the meter, so move along in the opposite direction. The first time you read 50 ohms again, you'll have moved to the connector just past the open spot.

It's wise to get baseline measurements of the resistances at many points along the cable when the system is operating properly. Then, when trouble strikes, you can compare the current readings with those from the baseline to help find the fault. Remember that a system with both terminators should measure about 25 ohms at all points, a system with one terminator should read about 50 ohms, and a cable with no terminators should have an infinite resistance.

In an installation of any size, you'll gain good insurance if you install a couple of Ethernet adapters in the server, allowing you to split the cable. With two separate wiring spans going to a server, you can avoid getting everyone mad at you when someone breaks the cable. You'll also be able to isolate the problem more quickly.

My idea of a perfect installation uses thin Ethernet cabling in a star wiring configuration. Coaxial cabling is easy to install, and the star wiring layout prevents disruption of the whole network. Many hub manufacturers offer BNC modules for their products. Using this configuration you can string some nodes on a daisy chain while giving others dedicated wire spans, avoid the distance limitations and crosstalk problems of unshielded twisted-pair cable, and build a highly reliable, flexible, noise-resistant wiring system. □

NETWORK YOUR QUESTIONS

Connectivity gives you practical solutions to networking problems of all types. We'll pay $50 for any tip we print. Please submit your letter on-disk along with a printout. Mail your contribution to Connectivity, *PC Magazine,* One Park Ave., New York, NY 10016. You may contact Frank J. Derfler, Jr., via MCI Mail (MCI ID: 240-2931) or the LAN Labs fax machine (904-267-1578).

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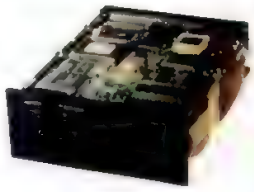

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PC MAGNET

ZVIEW: The Superior Way to View ZiffNet Text Files

BY PAULA LOVEJOY AND RYCK LENT

If you've ever downloaded a long text file, you know how difficult it can be to find the information you want. You sometimes even have to search through the entire file several times if related topics are at opposite ends of the file or buried somewhere in the middle.

Wouldn't it be nice if the information were presented in a neatly organized way, with outline-style headings, indexes, and links to related subjects? ZiffNet has the answer: ZVIEW.EXE, ZiffNet's own structured text-file viewer. ZVIEW is designed to work with files that have information coded in the ZiffNet tagged format and a .ZDG extension. When a .ZDG file is viewed, ZVIEW interprets these tags to present the information on-screen in an easy-to-understand, outline-style format. The .ZDG files are permanently compressed to save downloading time and precious hard-disk space. When loaded into ZVIEW they are decompressed on the fly, though they always remain in their compressed form on-disk.

ZVIEW's features include:

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- One-key navigation when viewing text. Using cursor keys or a mouse, you can scroll through text, advance to the next heading and associated text, move back to the previous combination, or return to the Table of Contents.
- Hypertext links to related topics. When the Link button is highlighted, you can click (using the Tab key or a mouse) to jump to the item described. Using the Esc key or Retrace button returns you to your starting point.
- A preset Keyword index to search topics within the document. Accessible from the Locate pull-down menu, the Key word index is an alphabetical listing of the major topics and subtopics in the document. You can click on an entry to jump directly to the associated text.
- User-controlled searching. Also accessible from the Locate pull-down menu, this feature allows you to search through the text of the current file for a particular word or phrase. When ZVIEW finds a match, the word or phrase (search string) is highlighted in the text and the heading of that text page is also highlighted. After expanding all the headings (Alt-E) and selecting and opening the first highlighted heading, you can move to each match sequentially using a single keystroke.
- Printing to a printer or to a file.
- User-modifiable color and sound settings.
- Single-key quick help with the F1 key in addition to extensive documentation in native ZVIEW format.

ZVIEW lets you organize the information available on ZiffNet in a way that's easy to use.

ZVIEW lets you organize the enormous amount of information available on ZiffNet in a way that makes the data more useful to you. The first ZiffNet offerings to benefit from the new file format are the Buyers' Digests. These buying guides pull together a vast amount of information about computer products and, with the help of ZVIEW, present it in an easy-to-use package.

Each Buyers' Digest features specifications and vendor information for every product in a category, along with background articles and reviews from major computer publications. For example, a Digest on low-cost 386SX notebooks includes 60 product specs, 55 company profiles, and 28 reviews. ZiffNet compiles the Digests from the Computer Database Plus and Computer Directory sections of Computer Library, then adds a buying checklist and a glossary of terms.

If you view the Buyers' Digest with ZVIEW, you can now read a product description, for example, and then jump to a review or a menu of reviews with a single keystroke or mouse click. You can also compare similar products on a feature-by-feature basis, jumping from one product spec to the next with one keystroke. The same is true for the vendor lists, which give the names and phone numbers of people to contact, along with background information about each company. Keyword searches let you easily find items of interest in the text—for example, which products have received *PC Magazine* Editors' Choice awards. (There is a surcharge for each Digest.)

Getting ZVIEW is easy: Just type GO ZNT:DIGESTS at the CompuServe ! prompt and download the ZVW.EXE self-extracting file, which contains both ZVIEW.EXE and the documentation for ZVIEW (ZVIEW.ZDG) in ZVIEW format. You can download ZVIEW at standard connect rates. After extracting ZVW onto your hard disk, type ZVIEW; this will run ZVIEW and the documentation file will load by default. If you downloaded other *.ZDG files, you can specify the directories where they are located (if different from the current one) by using the File, Directory pull-down menu (Alt-F) and making the change in the dialog box. Then use the File, Open pull-down menu to see the *.ZDG files available. Highlight your selection and click or press Enter to load the file. □

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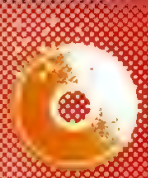

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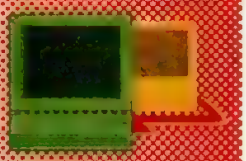

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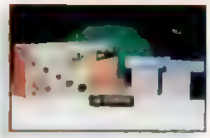

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Gordon Hoffstein, co-founder, *PCs Compleat*

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That's what Gordon Hoffstein and his partners had in mind when they founded PCs Compleat in January 1992.

"We wanted to give buyers a place where they could choose from a broad selection of leading national brands and still get all the advantages of buying from a first-rate direct marketer.

"For example, when a buyer calls us about laptops, we can offer him thirty different choices. And he can discuss the standard and optional

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features offered by each manufacturer with a technically sophisticated salesperson who has all the facts. We do custom configurations and load applications software. We'll install DOS or Windows, perform a complete system test, and ship the product out the same day it's ordered. And we provide toll-free lifetime technical support."

Hoffstein considers PCs Compleat a breakthrough concept in computer retailing. "When you have an idea this good, you don't want to be shy about it. That's why one of my first marketing decisions was to put a spread ad in every issue of PC Magazine, using the PC Direct section. And it's turned out to be our best lead generator by far."

The PC Magazine reader is Hoffstein's ideal customer.

"Not only does PC Magazine bring us a lot of customers, it brings us the kind of customers we want, those who know that value means more than just a low price.

"Because PC Magazine readers are knowledgeable about the products and features they want, they know what questions to ask our salespeople and they're ready to buy on the first call. They're also more interested in adding options like memory upgrades and fully-loaded software. And they can communicate with our technical support people in an efficient way."

If you're a direct marketer with a breakthrough idea, bring it to the attention of 900,000 of the most active and knowledgeable PC buyers. Call your PC Magazine sales representative or 212-503-5100 and get the facts about PC Direct.

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How PC Direct Helps Insight With its Zero-Defect Goal

"Our goal is zero-defect, and it seems within reach," says Eric Crown, CEO of Insight. "We've made enormous improvements in the way we build and test systems and drives, and it's paid off. We've had entire days when not a single service call was related to a quality control problem.

"One of the keys to achieving zero-defect was to get our sales volume up. That allows us to use the highest quality components in the business. It also allows us to invest in the best quality control systems."

Insight is attracting a bigger and bigger share of the direct market, and that kind of growth can be achieved in only one place—PC Magazine.

"We believe in PC Magazine's PC Direct section," says Valerie Paxton, Insight's Vice President of Marketing.

"The results of our advertising in PC Direct have been so terrific—today a salesperson told me he had 22 straight phone calls from PC Magazine readers—that we decided to increase our advertising presence in every issue from three pages to eight! The impact on sales of all our products—systems, software and Hard Drives International's mass storage products—has been phenomenal.

"PC Direct buyers can find our ads easily. And we know that because these are PC Magazine readers, they are smart buyers whose companies depend on them to specify brands of PC products, over and over again. In other words, these are customers who are going to be very valuable to us in the long term.

"PC Magazine's PC Direct section is a big hit for buyers and for Insight."

If you're a direct marketer, there's only one sure strategy—to grow faster than the competition. And there's only one sure way to do it—PC Magazine. For the facts on the PC Direct section call your PC Magazine sales representative or 212-503-5100.

Eric Crown, CEO and
Valerie Paxton, Vice President,

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CIRCLE 158 ON READER SERVICE CARD

How a Bigger Presence Translated.

"Growth has allowed us to make a greater investment in technical support," says Mike Zabaneh, vice president and co-owner of Tangent Computers.

"At this point we've got a staff of engineers dedicated to support, and we've been able to branch out beyond general support to specialized support for Unix and Novell networks."

Offering better customer services isn't the only benefit of Tangent's success. "We've taken advantage of increased sales to put more and more into R & D, and to improve the quality and reliability of the computers we produce. Judging by some of the good reviews we've gotten, it's paying off."

in PC Magazine Into Better Service for Tangent's Customers

Zabaneh attributes his greater share of the direct market to his advertising in PC Magazine. "PC Magazine is our single largest lead generator. Even better, the lifetime value of the customers we get through PC Magazine is unmatched. They buy from us again and again, through later magazine ads and through our catalog.

"What impresses me most about PC Magazine readers is their loyalty to the magazine. They really depend on it. We have many repeat customers, people who are very familiar with Tangent, who still refer to our most recent ad in PC Magazine when they order."

Zabaneh is a big fan of the PC Direct section. "We had been in the general part of the magazine, and decided to try out PC Direct.

"There was absolutely no decrease in response, and the savings allowed us to go from a single page to a spread in every issue. The return on investment has been excellent."

For direct marketers like Tangent, the only way to stay competitive is by increasing their share of the market. And that kind of growth can be achieved in only one place — PC Magazine. To find out how you can attract the most new customers with the greatest lifetime value at the lowest possible cost, call your PC Magazine or 212-503-5100 and ask about PC Direct.

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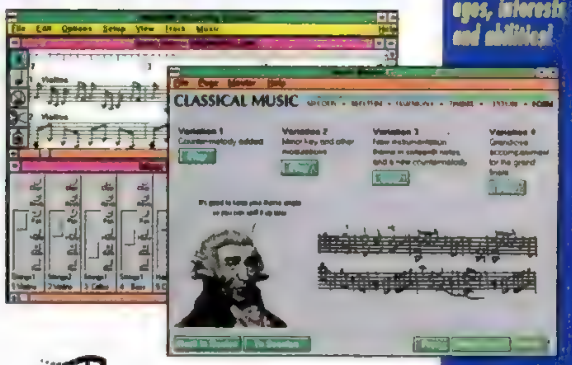

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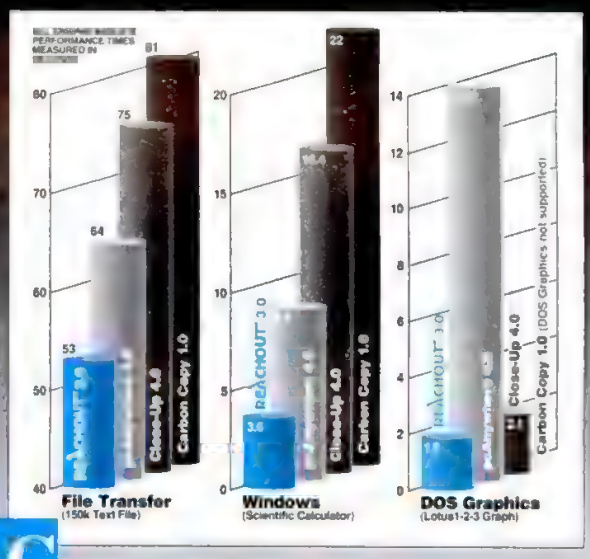

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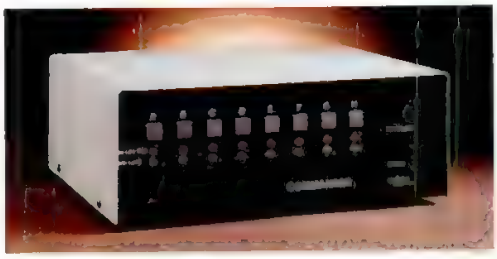

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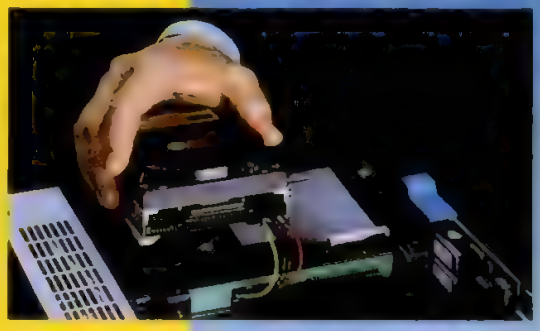

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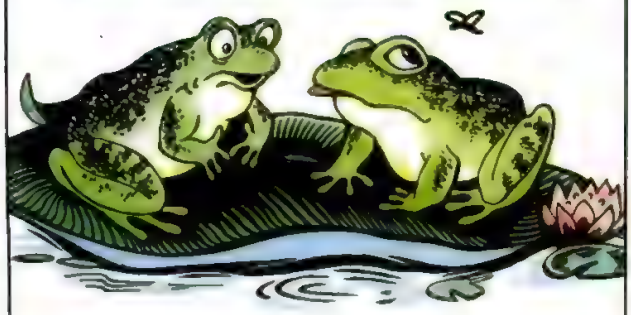

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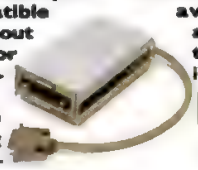

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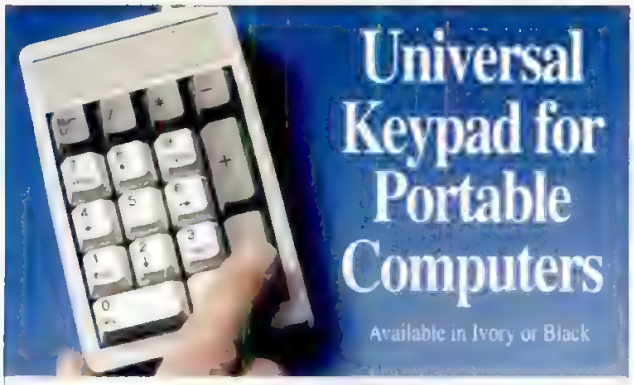

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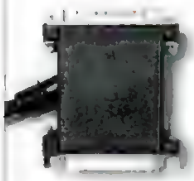

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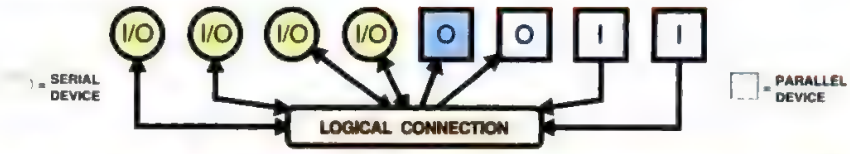

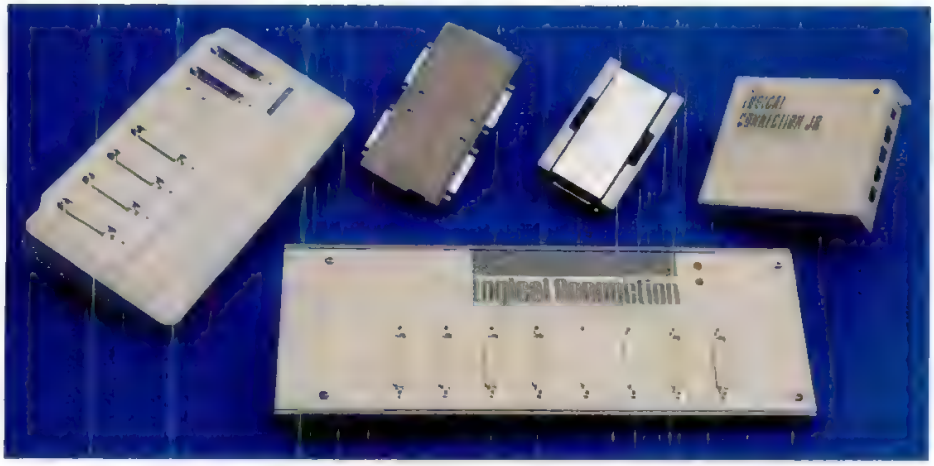

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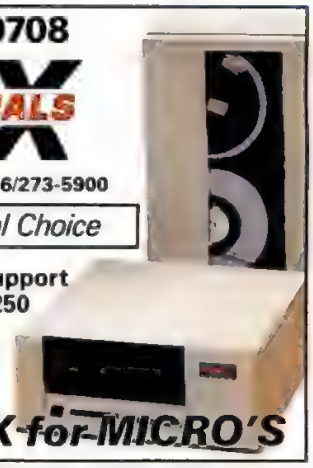

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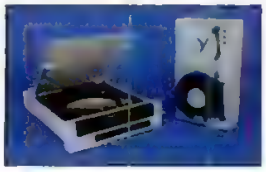

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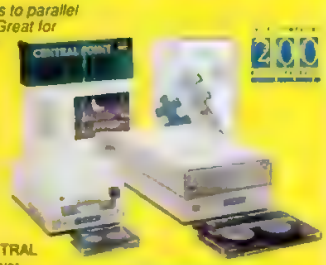

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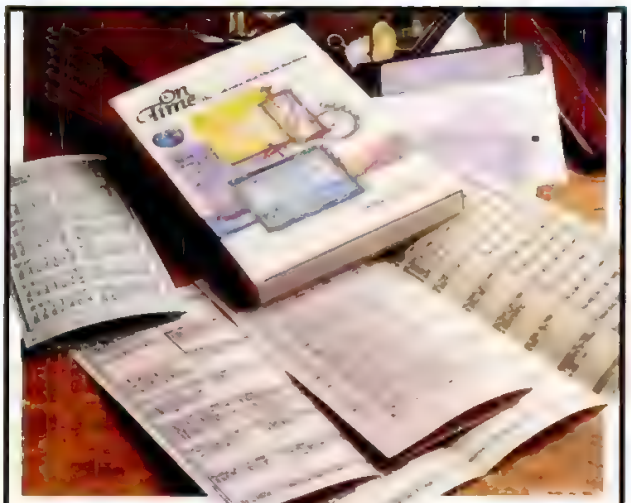

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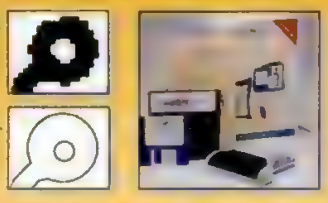

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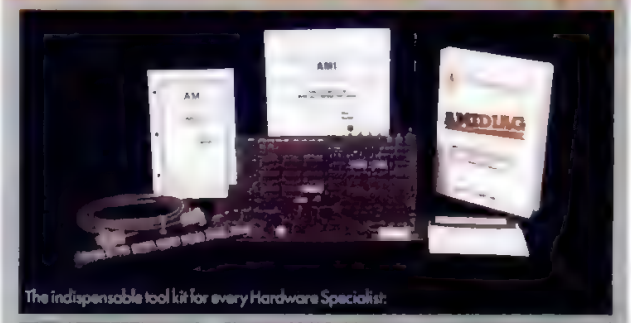

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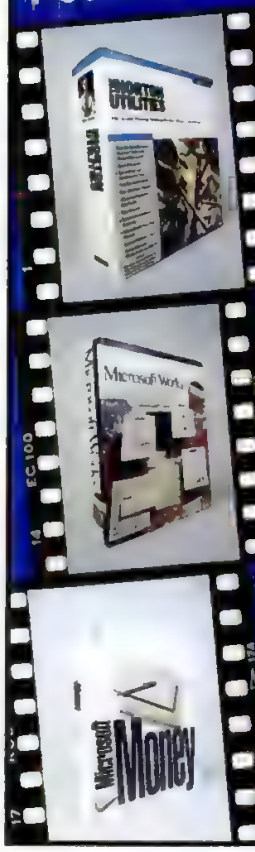

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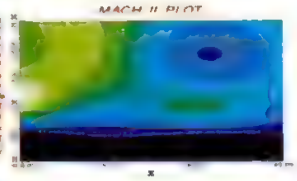

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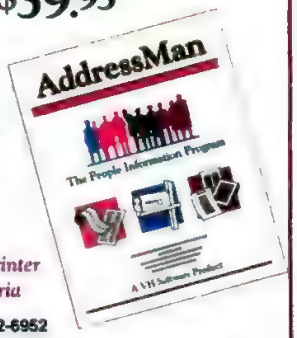

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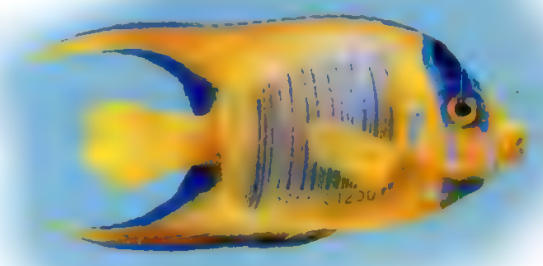

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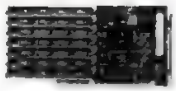

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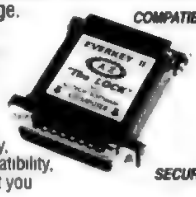

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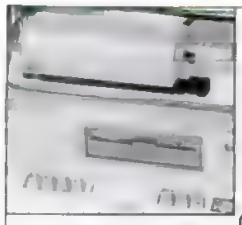

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PC Magazine is published 22 times a year, (bimonthly except for July and August). The BusinessCard closing is approximately two months prior to issue date.
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130	131	132	133	134	135	136	137	138	139	140	141
177	178	179	180	181	182	183	184	185	186	187	188
224	225	226	227	228	229	230	231	232	233	234	235
271	272	273	274	275	276	277	278	279	280	281	282
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365	366	367	368	369	370	371	372	373	374	375	376
412	413	414	415	416	417	418	419	420	421	422	423
459	460	461	462	463	464	465	466	467	468	469	470
506	507	508	509	510	511	512	513	514	515	516	517
553	554	555	556	557	558	559	560	561	562	563	564
600	601	602	603	604	605	606	607	608	609	610	611
647	648	649	650	651	652	653	654	655	656	657	658
694	695	696	697	698	699	700	701	702	703	704	705
741	742	743	744	745	746	747	748	749	750	751	752
788	789	790	791	792	793	794	795	796	797	798	799
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882	883	884	885	886	887	888	889	890	891	892	893
929	930	931	932	933	934	935	936	937	938	939	940
976	977	978	979	980	981	982	983	984	985	986	987
1023	1024	1025	1026	1027	1028	1029	1030	1031	1032	1033	1034
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1117	1118	1119	1120	1121	1122	1123	1124	1125	1126	1127	1128
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142	143	144	145	146	147	148	149	150	151	152	153
189	190	191	192	193	194	195	196	197	198	199	200
236	237	238	239	240	241	242	243	244	245	246	247
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988	989	990	991	992	993	994	995	996	997	998	999
1035	1036	1037	1038	1039	1040	1041	1042	1043	1044	1045	1046
1082	1083	1084	1085	1086	1087	1088	1089	1090	1091	1092	1093
1129	1130	1131	1132	1133	1134	1135	1136	1137	1138	1139	1140
1176	1177	1178	1179	1180	1181	1182	1183	1184	1185	1186	1187

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859	860	861	862	863	864	865	866	867	868	869	870
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953	954	955	956	957	958	959	960	961	962	963	964
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166	167	168	169	170	171	172	173	174	175	176	
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354	355	356	357	358	359	360	361	362	363	364	
401	402	403	404	405	406	407	408	409	410	411	
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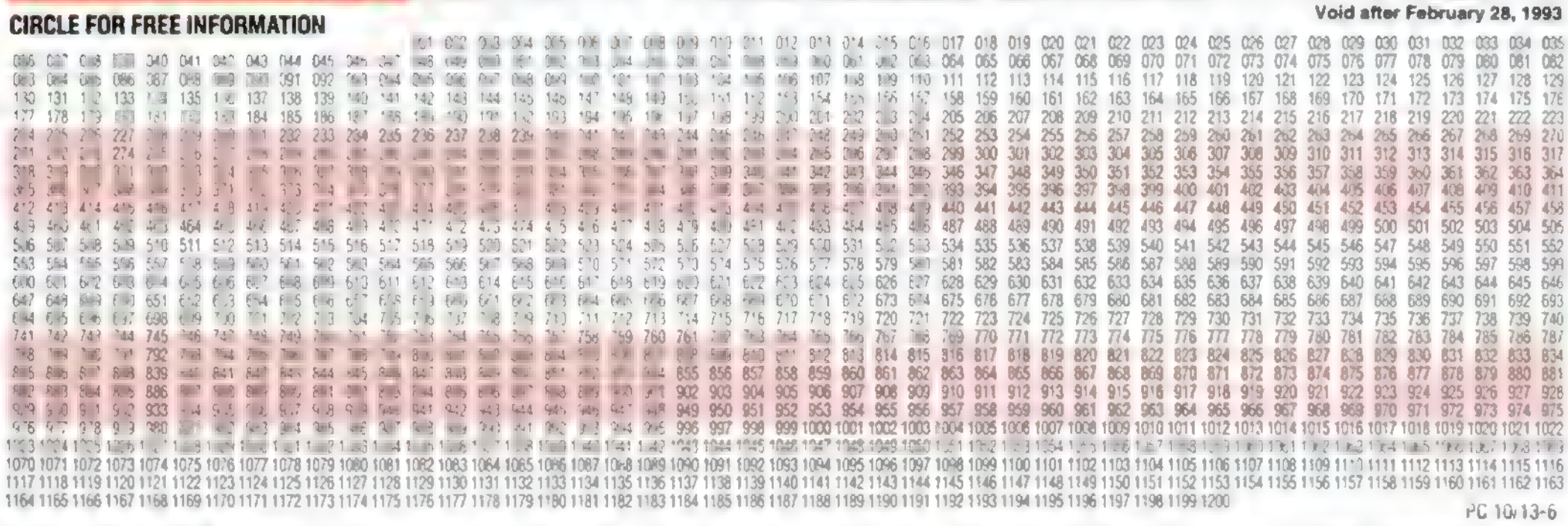

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04. ☐ No definite plans

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For Additional Categories See MARKETPLACE PRODUCT INDEX page 489

PC MAGAZINE

Coming Up

LAN-Based E-Mail

Thanks to today's sophisticated network mail, administrators and end users alike are able to connect through local and remote access, making e-mail an integral part of the group work process. In the next issue, we evaluate seven electronic-mail software packages with both DOS and Windows front ends.

Subnotebook PCs

Just when the power of the portable notebook approaches that of the desktop PC, vendors aim to shrink the case even further. *PC Magazine* takes a close look at the first 2- to 4-pound systems and their cutting-edge technology, including subminiature hard disks, PCMCIA cards, low-power circuitry, and wireless communications.

Business Illustration

With a top price well under $200, high-end tools, and a variety of clip art, the right illustration package turns even the most artistically challenged into a creative whiz. For help with designing maps, logos, and ads, we'll tell you which of these five products are lost-cost and which are just low-end.

Local-Bus Video

The hottest new buzzword in the computer industry is *local bus*, and it's coming to your desktop soon. Faster video performance is just one of the benefits; local-bus technology will also affect everything from caching disk controllers to network interface cards. *PC Magazine* takes an in-depth look at the new technology and also tests a few preliminary products.

Network Modems

If you work on the road, or at a remote site, you fall out of the central LAN loop. Enter remote-client products. PC Magazine Labs reviews this new breed of dial-in solution that connects remote PCs as if they were actual nodes on the LAN. But are these modems fast enough?

Utilities

The battery-powered clocks in 286-based PCs and later tend to lose time. An inaccurate clock might make you late for your meetings, and it can also cause more serious problems such as losing track of file changes because of incorrect date/time stamps. WTIME, next issue's utility, will help you keep your PC's clock right. With a click of the mouse and a quick call to the National Institute of Standards and Technology, WTIME will ensure that your clock remains accurate.

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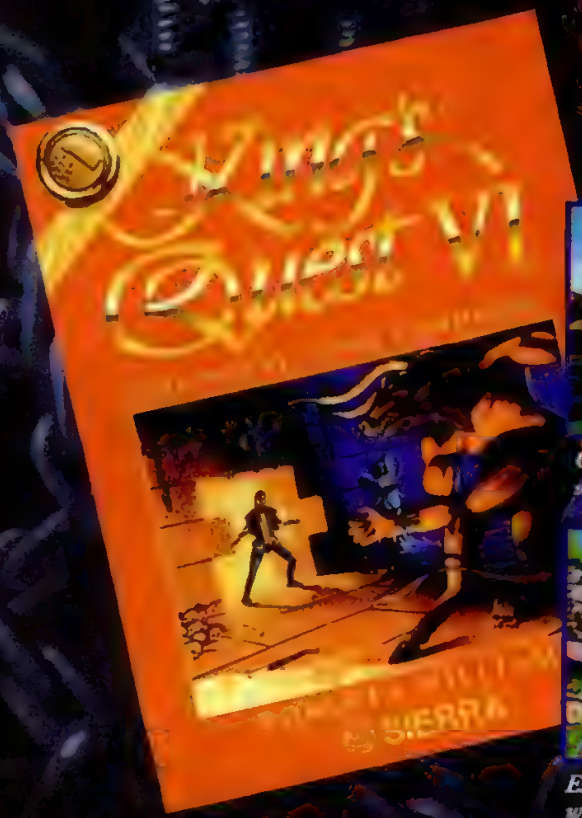

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Resumes: *WinWay Resume, PFS:Resume* **Hobbies:** *Sport Card Organizer, Organize! Your Collection* **Games:** *NYT Crosswords, Planet's Edge*

RESUMES

Produce Winning Resumes Under DOS or Windows

BY DON TRIVETTE

One of the most perplexing things about applying for a new job (or a first job) is drawing up a resume. Where does the name go? Should education follow work experience? What about the objective? References?

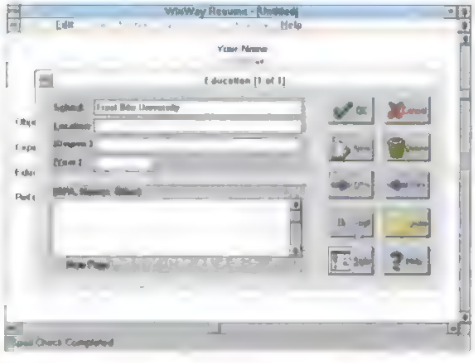
WinWay Resume, from WinWay Corp., and Spinnaker Software's PFS:Resume & Job Search Pro answer these questions and more. WinWay, as the name suggests, is a Windows application; PFS:Resume is a DOS product. The differences between the two packages are more than operating-system deep, however. WinWay has a more intuitive interface, but PFS:Resume has features that go beyond simple resume writing. It's a job-searching system.

Both WinWay Resume and PFS:Resume & Job Search Pro reduce resume writing to filling out a form. Likewise, both packages produce beautiful output—even from an inexpensive 9-pin dot-matrix printer. Each package shows you exactly how your resume will look—fancy typefaces, bold printing, and all—before it's printed. Each package also has a print-to-file technique that allows you to prepare a resume and take it to an outside source for high-quality output.

Of the two programs, I preferred WinWay Resume, even though the package had a few bugs. It was so well designed and easy to use that I never had to crack the manual.

WINWAY RESUME

The WinWay Resume user interface is so slick you'll wonder why WinWay sent along a 50-page printed manual. To get started, click on New Resume and a template appears showing sections such as Heading, Education, and Experience. Click in the "Heading" area and a window pops up, with space for your name, address, and phone numbers. That's how the software handles data input for each section; it's as simple as clicking and filling out a form.



WinWay Resume's point-and-click Windows interface makes creating a resume as easy as filling out a form.

The package gives you a wide range of formats for each section, all of which can be applied with a click of the Style button. For instance, you can set your heading 17 different ways: right justified; left justified; centered; name right, address left; name left, address right; and so on. If you don't care for the built-in Objective, Experience, Education, and References section names, you can change those, too.

Though PFS:Resume's interface is not as pretty as WinWay's, the package gives you enough options to organize your entire job search.

The font menu lets you set the typeface, point size, and style (bold, italic, underline) for each section. Your choices, however, depend on your particular printer and the typefaces installed with Windows. Each section can have its own typeface, but you cannot change style within a section. For example, WinWay cannot set the names of books and magazines in italic type within the Experience section without setting the entire section in italics. The developer recognizes this and is working on a fix for the next release.

WinWay has all the features you would expect in a first-class product, including a spell-checker and a quick-access menu that lets you jump easily to Windows' built-in calendar, cardfile, and word processing program.

WinWay Resume, *$69.95.* Requires: *2MB RAM, DOS 3.1 or later, Windows 3.x. WinWay Corp., 5800 Madison Ave., Suite A-20, Sacramento, CA 95841; 916-332-2671; fax, 916-332-2529.*

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PFS:RESUME & JOB SEARCH PRO

If you are used to Windows' simplicity, the DOS-based PFS:Resume & Job Search Pro's 150-page manual and less-than-intuitive interface may put you off at first. To be fair, though, PFS:Resume includes some features that WinWay lacks, such as tools for writing cover letters, scheduling appointments, and maintaining a mailing list. It is a complete system for job hunting.

PFS:Resume has templates for nine types of resumes: Quick & Easy, General, Standard, Business, Engineering, Student, Computer, Professional, and Academic. Pick a template, go to a section, fill in the blanks, and then go to the next section. The use of function keys instead of a point-and-click interface makes PFS:Resume's data input and navigation more cumbersome than WinWay's.

Resumes

By setting each section for free-form input, you can completely control the style and form of a resume. WinWay Resume doesn't have this flexibility. PFS:Resume comes with 36 fonts and variations, but, as is the case with WinWay, you cannot set book and magazine titles in italics.

The mail-merge feature is useful if you're applying to dozens of places. Type one cover letter, and mail-merge can automatically address it to everyone on your mailing list. The appointment scheduler reminds you when to follow up with phone calls.

PFS:Resume & Job Search Pro is designed for someone who is practically making a career of applying for jobs—including, perhaps, someone who's in the resume-writing business. Whichever software you use, however, remember that content, not style or form, will ultimately put you on the payroll.

PFS:Resume & Job Search Pro, *$59.95.* Requires: *640K RAM, DOS 3.1 or later. Spinnaker Software Corp., 201 Broadway, Cambridge, MA 02139; 800-826-0706, 617-494-1200; fax, 617-494-1219.*

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AbraScan Automates Resume Processing

Tired of sorting and shuffling resumes and making out reports? Let your PC do it. AbraCadabra Software's AbraScan, an electronic resume reader, can process job applications at the rate of 6 per minute.

AbraScan uses a standard optical character reader to convert typewritten, typeset, laser printed, and dot matrix material into computer-readable form. Relevant data—name, address, education, skills, and employment dates—is extracted and put into a database for AbraTrak, the companion software.

The quality of your optical scanning equipment determines how well AbraScan will work. A $1,000 OCR machine can process a page in about 2 minutes; a $45,000 high-speed scanner speeds through six resumes a minute with minimal operator intervention. Good quality intermediate-level scanners are available for $2,000 to $4,000.

Once the resume information is captured, AbraTrak takes over. It allows a recruiter to query the applicant pool for a single skill or any combination of skills. For example, you may ask to see all applicants who speak Spanish and have spreadsheet experience.

AbraTrak can generate more than 50 standard reports and summaries; custom reports can be programmed with dBASE. A network version lets several recruiters access the database at the same time.

AbraScan, *$3,000;* **AbraTrak,** *$1,000.* Requires: *640K RAM, OCR hardware/software, DOS 3.1 or later. AbraCadabra Software Inc., 5569 Ninth Street N., St. Petersburg, FL 33703; 813-525-4400; fax, 813-525-3254.*

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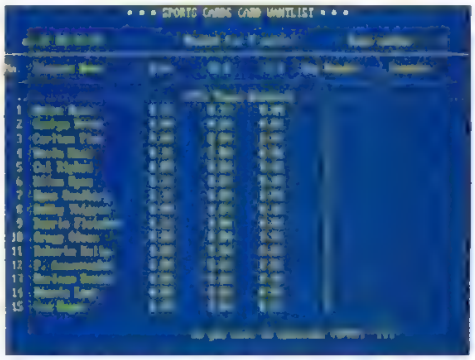
HOBBIES

Two Databases Keep Track Of Your Sports Card Collections

BY DON TRIVETTE

Although most baseball cards are worth only a few cents, there are notable exceptions. The 1958 Ted Williams goes for $375, and the 1963 Hank Aaron appraises at $140. Indeed, last year Wayne Gretzky and a co-collector spent a reported $451,000 for the ultimate baseball card: a 1910 Honus Wagner. Wouldn't you like to know if you're holding onto a valuable card, too?



Sport Card Organizer and its accompanying databases let you see information about more than 88,500 cards, from 1950 to 1990.

If sports-card collecting is your hobby, business, or investment strategy, Sport Card Organizer and Organize! Your Collection may be just the incentive you need to put your cards in order. While Sport Card Organizer has the larger database and includes three other sports, Organize! Your Collection has stronger sorting and searching capabilities.

SPORT CARD ORGANIZER

Sport Card Organizer lets you choose one of four sports: baseball, basketball, football, and ice hockey. The software lets you enter information about the player (such as name, year, and sport) and about the card (such as value, set code, number in set, issuing company, condition, and year purchased). A group-entry option makes it easy to keep track of sets.

SCO's strength lies in its companion databases. The $49.95 package comes with 1992 data about 24,000 sports cards from 11 different publishers. Serious collectors will want the five optional databases that cover 1950 to 1989 ($20 each). The complete set of six covers 88,500 different cards published over the past 42 years. These databases and annual updates are available from Compu-Quote Inc. (6914 Berquist Ave. Canoga Park, CA 91307; 800-782-6775).

In addition to the biographical information in the database, each card has a value based on its condition and averages compiled from auctions, price guides, dealer lists, and magazines like the *Baseball Card Price Guide.* Annual value updates are available for $10 per database.

The user interface is not very sophisticated by today's standards; a point-and-shoot menu or mouse interface would be a welcome improvement. Instead, you must use a numeric menu to switch among tasks like file maintenance, summary reports, want

list, and market-value updating. Another limitation is the program's inability to search for a card by player name; inquiries can be made only by set number and card number.

Sport Card Organizer, *$49.95;* additional databases, *$20.00.* Requires: *512K RAM; DOS 2.1 or later. Ninga Software Corp., 736 8th Avenue SW, #330, Calgary, Alberta, Canada T2P 1H4; 800-265-5555, 403-265-6611.*

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ORGANIZE! YOUR COLLECTION

Organize! Your Collection, from HomeCraft, doesn't stop with sports card collections. Organize! has predefined formats for different types of collections, ranging from comic books to coins, stamps to baseball cards.

Organize! has several useful features that Sport Card Organizer lacks. For instance, it can sort by any field or combination of fields, and search for a card by player name or team. Want to see Ted Williams? Just enter his name. Organize! can also import and export files in the popular dBASE III format. You can also customize this database by adding or removing fields. There's a point-and-shoot menu, but the developer is still working on the mouse interface.

A general-purpose database for hobbyists, Organize! Your Collection has formats for collections from baseball cards to postage stamps.

The Sports Card Collectors' version of Organize! comes with a database of 8,000 Topps baseball cards dating from 1955. Databases of three other publishers' cards are available for $10 each, although these databases are less extensive than the one for Topps cards. Values for cards are compiled from 20 dealers across the nation. Cards worth more than $1 are recorded in the database. A yearly update disk is available for $5.

Organize! Your Collection (Baseball), *$79.95;* additional databases, *$10.00.* Requires: *350K RAM, DOS 3.0 or later. HomeCraft Software, P.O. Box 974, Tualatin, OR 97062; 503-692-3732*

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GAMES

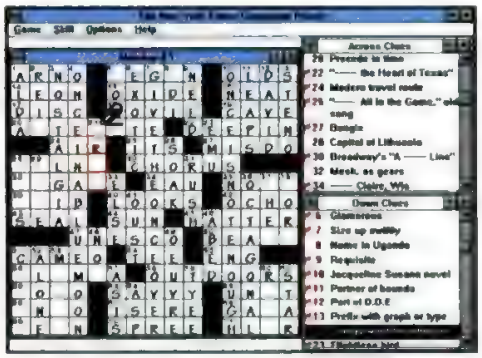
NY Times Crossword Puzzle Gets Windows Treatment

BY DON TRIVETTE

What has 31 letters and spells hours of intellectual challenge and fun? The New York Times Crossword Puzzles by Swfte International. This collection of 200 of *The New York Times*' daily puzzles and 50 of the world-class Sunday bafflers runs under the Windows interface.

The puzzles, which originally ran in the newspaper during the 1970s, 1980s, and 1990s, are arranged by days of the week. The *Times* puzzles grow more difficult as the week progresses: Monday's puzzles are easiest, Saturday's difficult, and Sunday's are legendary. You can select any puzzle; you don't have to complete Monday's before trying Tuesday's.

Because the weekday crossword is 15 rows by 15 columns, the entire puzzle fits onscreen. Sunday's challengers are larger (21 rows by 21 columns) and won't fit in a window without scrolling. In both cases, across and down clues fit in separate scroll windows beside the puzzle. A legible pencil-font typeface enhances the graphics, and puzzles can be printed for true portability.



The New York Times Crossword Puzzles' daily 15-by-15 box fits on-screen with clues, but the 21-by-21 Sunday puzzle requires scrolling.

NYTCP has three skill levels. The novice level will not allow you to put an incorrect letter in a box, but it will leave the portion of an entry that's correct. If the word is HOG and you type DOG, for example, the OG will appear in the second and third boxes but the first box will remain blank. The intermediate level lets you enter an entire word and then signals if it's incorrect. You don't know which of the letters are accurate. The advanced level simulates actual pencil-and-paper play. You can put any letter in any box and the software keeps a poker face. If you feel compelled to cheat, though, there's a "peek" command.

The software can save games in progress, and you'd be wise to do so. Although I did lose work to several allocation-error crashes, it wasn't as bad as losing a word processing file!

You can select a word for play by clicking the mouse's left button on the across or down clue, or by clicking on the puzzle's boxes. If you use the latter method, you have to use your right mouse button to toggle between the across and down words. This is unnecessarily clumsy when the left button could have done it all, but it's the only flaw in an otherwise excellent interface.

Even if you're used to *TV Guide* crossword puzzles, you may be pleasantly surprised to find that *The New York Times*' puzzles are not out of your league—at least not the weekday ones. For crossword puzzle devotees with access to Windows, this is M-U-S-T H-A-V-E software.

The New York Times Crossword Puzzles, *$69.95.* Requires: *1MB RAM, Microsoft Windows 3.x, DOS 3.1 or later. Swfte International Ltd., 724 Yorklyn Road, #150, Hockessin, DE 19707; 800-237-9383, 302-234-1740; fax, 302-234-1760.*

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GAMES

New World Computing Leaves the Dungeon with Planet's Edge

BY BARRY BRENESAL

Planet's Edge represents a departure for New World Computing. The company has come out of the dungeon at last, with its latest adventure taking place in outer space.

Several nonterrestrial species have recently set out to destroy Earth. Your job is to lead a party of four in a galaxywide search for eight alien artifacts that, when combined, will restore the planet.

Each member of your group is rated for 16 separate skills. You fly the experimental spacecraft Ulysses and find new raw materials and higher technologies on each of eight separate quests. The artifacts you seek aren't lying around for the taking. Some are hidden; others are in the possession of other species (both friendly and not-so-friendly) with problems of their own.

The graphics quality of Planet's Edge is mixed: It is excellent at the moonbase facilities, good on planet surfaces, and stiff in space.

Imaginative story development makes this game shine, however. Developer Jon Van Caneghem's quest scenarios vary in difficulty but always exhibit originality and a gift for satire.

Though combat is necessary for success, in Planet's Edge it isn't necessarily constant. Planetary encounters can have violent and nonviolent resolutions. Planet's Edge is also surprisingly forgiving. Your group can usually teleport out of a bad planetary situation back to relative safety aboard ship. If a party member dies, the inventory is saved and the character resurrected in the cloning bays back on moonbase.

The game's single weak element is the way it handles ground movement among your party of four. The characters often get separated at doors and in multipath corridors. This aside, Planet's Edge is a pleasant way to wait for New Worlds' next dungeon adventure. □

An extraterrestrial adventure, Planet's Edge weaves challenging puzzles into an imaginative tale.

Planet's Edge, *$59.95.* Requires: *640K RAM, 4.2MB hard disk space, DOS 2.0 or later. New World Computing, P.O. Box 4302, Hollywood, CA 90078; 818-999-0606; fax, 818-593-3455.*

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MOVING?

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Sometimes, the worst thing you can do to a drug user is the only way to help.

Drug use is a question of extremes. People who use drugs are either addicted or in danger of addiction.

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Addicts seldom get well or even get into treatment by themselves. Someone has to help. You could be that person. If you're willing to get involved.

When you say, in no uncertain terms, "Get well or get out," you may be awakening the addict to the one reality that can save her.

Threatening to fire an addict is the worst thing you can do to her. Or the best. If it gets her into treatment.

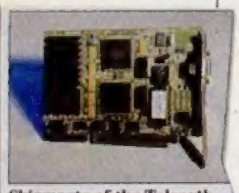
To find out how to set up a treatment program in your company, please call 1-800-843-4971. That's the National Institute on Drug Abuse hot line for managers and CEOs. It's manned by trained Employee Assistance Program planners and designers, from Monday through Friday, 9:00 a.m. to 8:00 p.m. Eastern Time. They won't tell you what to do, but they can outline the options.

Partnership for a Drug-Free America

Abort, Retry, Fail?

THE LIGHTER SIDE OF PERSONAL COMPUTING

By Bill Howard



Shipments of the Telepath modem, twice held up by bugs, are due to begin again in July

No wonder they didn't work: This Gateway Telepath modem looks more like a video card. (*PC Week*, May 25, 1992)

New Math I

"The new i486 DX2-66 chip uses Intel's so-called clock-doubling technology to achieve speeds of 66 megahertz . . . . The difference between 50 million cycles a second and 66 million might seem silly. Still, to computer users who demand the fastest available processors for jobs like searching through big data base files, the extra 15 million cycles are important."
—*The New York Times*, August 18, 1992

New Math II

"The computerwise can start with the final chapters (almost any personal computer will be adequate; DOS machines with 80,286 chips are fine) and work back for more insight."
—*Scientific American*, January 1992

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New Math III

Maybe you should buy ten books and get them for free? The subject matter may be exacting and technical, but the math doesn't seem to add up in this M&T Books 1992 catalog offer.

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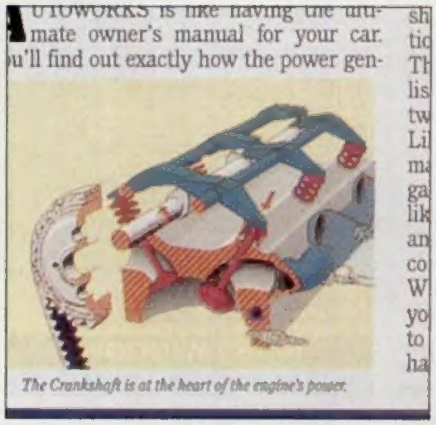
According to the spring 1992 Harbor Freight tools catalog, this is a surge suppressor.

Amazing Facts

"IBM's revamped RISC architecture enables [RS/6000] systems to perform up to four instructions per second, a feat unmatched in the industry at press time."
—Supplement to *Midrange Systems* magazine.



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The Crankshaft is at the heart of the engine's power.

The crankshaft may be the heart of the engine's power, as you'll learn in the $79.95 Autoworks program offered in the Tiger Software catalog, but the camshaft is what you see in the screen photo.

Some of Us Think They Succeeded

"IBM and Microsoft, now barely on speaking terms, once collaborated to develop aversion of OS-2."
—*Albuquerque Journal (N.M.)*, April 7, 1992

RICHARD TENNANT

If your entry is used in Abort, Retry, Fail? we'll send you $50 and a *PC Magazine* T-shirt. Caution: In case of multiple entries, the postmark date, neatness, and completeness of each entry are considered. Winners this issue: Charlie Cox (modem or video board), Walter and John Jeffries (surge-suppressor saw), A.A. Wiebe (80,286 chips), Dennis H. Owen (30 percent savings), Joseph S. Martin (4 IPS), J. Bergman (crankshaft vs. camshaft), Claus Whiteacre (aversion to OS/2).

MURPHY'S LAW #17

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MURPHY'S LAW #43

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